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Contents

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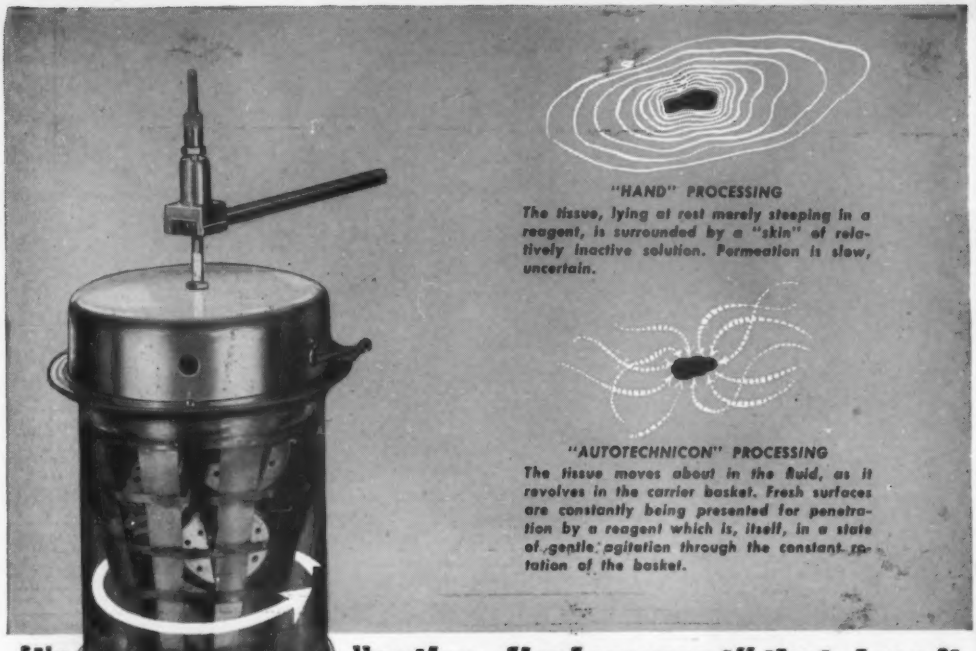

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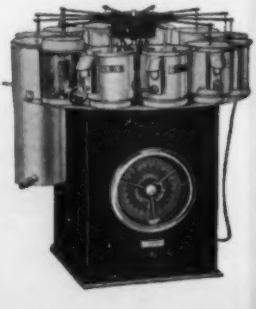

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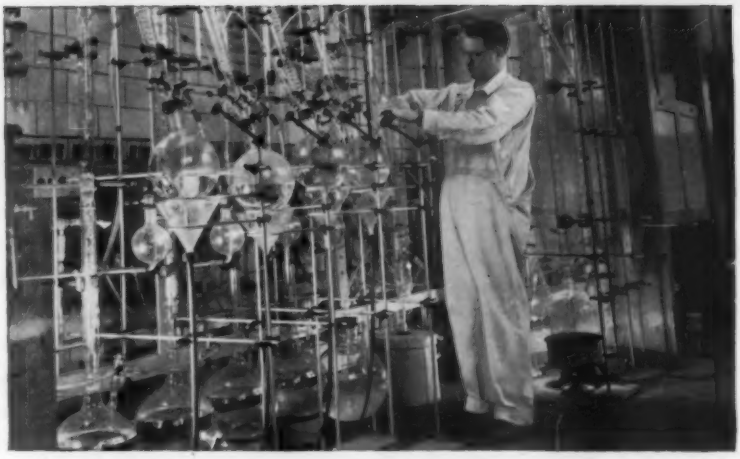

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The work of the several committees is directed by the Executive Committee, comprising the three presidents, the Administrative Secretary, and eight members elected by the Council (*Science*, 113, 3 [advertising section] January 5, 1951). Efficiency within the Executive Committee is enhanced by means of subcommittees—namely, Budget (Kirtley F. Mather, chairman), Building (Roger Adams, *chairman*), Publications (Fernandus Payne, *chairman*). Other Association committees, charged with important tasks, include Finance (Frederick P. H. Siddons, *chairman*); Affiliation and Association (Malcolm H. Soule, *chairman*); Bylaws and Constitution (Kirtley F. Mather, *chairman*); Evaluation of Scientific Merit (Paul B. Sears, *chairman*); AAAS–George Westinghouse Science Writing Awards (Howard A. Meyerhoff, *chairman*); Thousand Dollar Prize (John R. Dunning, *1950 chairman*); Theobald Smith Award (Malcolm H. Soule, *chairman*); Symposia at the Philadelphia Meeting (Kirtley F. Mather, *chairman*); World Federation of Associations for the Advancement of Science (Kirtley F. Mather, *chairman*); Relations with Scientific Organizations (Roger Adams, *chairman*). Between Executive Committee meetings an Emergency Committee consisting of the three presidents acts on matters requiring prompt attention.

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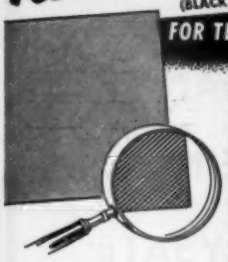

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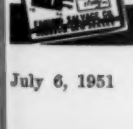

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The California Oath

A writ issued by J. Peek, P. J. Adams, and J. Van Dyke

Of District Court of Appeal for the State of California
In and for the Third Appellate District

THIS IS AN ORIGINAL PROCEEDING for a writ of mandate to compel the Board of Regents of the University of California and Robert M. Underhill, as Secretary and Treasurer thereof, to issue to petitioners herein letters of appointment to positions as members of the faculty of the University for the academic year of July 1, 1950, to June 30, 1951.

The petition alleges that petitioners are members of the faculty of the University of California of Academic Senate rank; that respondents are each members of a public corporation known as the Regents of the University of California; that the Regents, in accordance with authority granted to them by the State Constitution, have established an Academic Senate vested with certain powers relating to appointment, tenure and dismissal of faculty members; that the Regents on April 21, 1950, adopted a resolution (more particularly set forth hereinafter) carrying out certain recommendations of the California Alumni Association relative to the signing of a so-called "Loyalty Oath" by the faculty of the University; that each of the petitioners (all of whom are nonsigners thereof), pursuant to the resolution, petitioned the President of the University for a review of his case by the Committee on Privilege and Tenure of the Academic Senate; that each petitioner appeared before the said committee which, after full investigation, recommended the appointment of each petitioner to his regular post on the faculty of the University; that on July 21, 1950, upon the recommendation of the President of the University, the Regents by resolution appointed each of the petitioners to his respective post; that notwithstanding their appointments, respondent Underhill refused to transmit letters of appointment to petitioners; that subsequently on August 25, 1950, the Regents refused to recognize the appointment of petitioners; that if respondent Underhill is not ordered by this court to transmit the letters of appointment, irreparable injury to both petitioners and the people of the State of California will result; that petitioners have no plain, speedy or adequate remedy at law.

To this petition respondents filed their general and special demurrer and answer. This court on September 1, 1950, ordered that respondents take no action to enforce any resolution with respect to the nonappointment of petitioners or termination of their posts and that the ten-day period granted petitioners by respondents should not expire until ten days following any further order of this court specifying that such period shall commence to run.

Before discussing the facts of the dispute which culminated in the filing of this petition it is important to note by way of background that the Regents of the University in 1920 by resolution provided "that appointment as associate or full professor carries with it the security of tenure in the full academic sense." At no time prior to the present controversy was that resolution superseded or modified. It further appears that since 1920 the Regents and the faculty of the University have considered professors of the designated rank as not subject to arbitrary dismissal and entitled to all the incidents of tenure as it is commonly understood in American universities.

The record further discloses that for approximately a year and a half prior to April 21, 1950, the Regents, the faculty, and the Alumni Association had considered the question of ways and means to implement the stated policy of the Regents of barring members of the Communist Party from employment at the University by means of a "Loyalty Oath." These discussions culminated in a meeting held on April 21, 1950, at which the Regents passed a resolution providing that after July 1, 1950, the beginning date of the new academic year, conditions precedent to employment or renewal of employment at the University would be (1) execution of the constitutional oath required of public officials of the State of California, and (2) acceptance of appointment by a letter which contained the following provision:

> Having taken the constitutional oath of office required of public officials of the State of California, I hereby formally acknowledge my acceptance of the position and salary named, and also state that I am not a member of the Communist Party or any other organization which advocates the overthrow of the government by force or violence, and that I have no commitments in conflict with my responsibilities with respect to impartial scholarship and free pursuit of truth. I understand that the foregoing statement is a condition of my employment and a consideration of payment of my salary.

The resolution further provided that,

> In the event that a member of the faculty fails to comply with any foregoing requirement applicable to him he shall have the right to petition the President of the University for a review of his case by the Committee on Privilege and Tenure of the Academic Senate, including an investigation of, and full hearing on the reasons for, his failure so to do. Final action shall not be taken by the Board of Regents until the Committee on Privilege and

Tenure, after such investigation and hearing, shall have had an opportunity to submit to the Board, through the President of the University, its findings and recommendations. It is recognized that final determination in each case is the prerogative of the Regents.

Some thirty-nine professors at the University who refused to sign the affirmation set forth in the Regents' resolution accepted what they apparently believed to be the alternative to the signing of the oath as set forth in the resolution and petitioned the President of the University for a hearing before the Committee on Privilege and Tenure of the Academic Senate. The hearing resulted in favorable findings and recommendations by that committee as to each of the professors. On July 21, 1950, the Regents met and by a vote of 10 to 9 accepted those recommendations and appointed the nonsigning professors to the faculty for the coming academic year. Following the passage of the resolution one of the Regents gave notice that he would change his vote from "No" to "Aye" and move to reconsider at the next meeting. At the next meeting of the Regents, on August 25, 1950, a motion to reconsider the matter of the appointments was passed by a vote of twelve to ten (one absent member stated by telegram that he would vote "no" if he were present), and the resolution adopting the recommendations of the Committee on Privilege and Tenure and appointing the professors to the faculty was defeated by a like vote of twelve to ten. Following this a motion was unanimously carried granting the nonsigning professors ten days in which to comply by signing the statement prescribed in the resolution of April 21.

Petitioners herein were among those professors who refused to sign the so-called "loyalty" statement. All the petitioners are scholars of recognized ability and achievement in their respective fields. Additionally it should be noted that it is conceded that none of the petitioners has been charged with being a member of the Communist Party or in any way subversive or disloyal.

Article IX of the Constitution which declares the policy of this state as to education provides at the outset in Section 1 thereof that education is "essential to the preservation of the rights and liberties of the people. . . ." Section 9 of that article establishes the University of California as a "public trust, to be administered by the existing corporation known as 'The Regents of the University of California,' with full powers of organization and government, subject only to such legislative control as may be necessary to insure compliance with the terms of the endowments of the university and the security of its funds." Thereafter follow detailed provisions relating to the membership of the Board of Regents and their powers and duties. The Section concludes with this provision: "The university shall be entirely independent of all political or sectarian influence and kept free therefrom in the appointment of its regents and in the administration of its affairs. . . ."

It is evident therefrom that the Constitution has conferred upon the Regents broad powers with respect to the government of the University. It follows that this court may not inquire lightly into the affairs of the Regents, and should exercise jurisdiction only where the Regents have acted without power in contravention of law.

The validity of the action taken by the Regents on August 25, 1950, is first challenged by petitioners on the ground that the affirmative statement demanded as a condition to their continued employment is a violation of Section 3 of Article XX of the Constitution which prescribes the form of oath for all officers, executive and judicial, and concludes with the prohibition that "no other oath, declaration or test, shall be required as a qualification for any office or public trust."

Respondents' answer to this argument is that the constitutional provision is not here applicable because members of the faculty of the University do not hold office or positions of public trust. In support of their position respondents place great reliance on Leymel v. Johnson, 105 Cal. App. 694. There it was held that Section 19 of Article IV of the Constitution, which provides that "No Senator or member of Assembly shall, during the term for which he shall have been elected, hold or accept any office, trust, or employment under this State; provided, that this provision shall not apply to any office filled by election by the people," did not preclude a member of the legislature from also holding a position as a teacher in the public schools of the city of Fresno. The court's holding was that the position of instructor in a public school was not an "office, trust, or employment under this State," as those terms are used in Section 19 of Article IV of the Constitution.

That the decision is limited to the particular provision of the Constitution therein questioned is indicated by the fact that the court gave serious consideration to the purposes of the people in adopting that section of the Constitution. This court held that the intent and purpose of said section was that "those who execute the laws should not be the same individuals as those who make the laws."

There is nothing in . . . any case cited by respondents which is conclusive of the status of petitioners with respect to the constitutional oath of office as set forth in Section 3 of Article XX. Furthermore, it is necessary in this case, as it was in the Leymel case, in dealing with another provision of the Constitution, to consider the purposes and intent of the people of California in adopting said Section 3 of Article XX. While the courts of this state have had no occasion in the past to discuss specifically the purposes behind this section, the history of the English and American peoples in their struggle for political and religious freedom offers ample testimony to the aims which motivated the adoption of the provision.

A similar provision is found in Clause 3 of Article 6 of the Federal Constitution where it is stated that all legislative, executive, and judicial officers, both of the United States and of the several states, shall be

bound by oath or affirmation to support the Constitution; but no religious test shall ever be required as a qualification to any office or public trust under the United States. Speaking of this provision, Chief Justice Hughes . . . said:

> I think that the requirement of the oath of office should be read in the light of our regard from the beginning for freedom of conscience. . . . To conclude that the general oath of office is to be interpreted as disregarding the religious scruples of these citizens and as disqualifying them for office because they could not take the oath with such an interpretation would, I believe, be generally regarded as contrary not only to the specific intent of the Congress but as repugnant to the fundamental principle of representative government.

Again, Justice Holmes said, ". . . if there is any principle of the Constitution that more imperatively calls for attachment than any other it is the principle of free thought—not free thought for those who agree with us but freedom for the thought that we hate."

In the Girouard case, which was the last in this line of cases involving aliens who had been barred from naturalization because their then religious beliefs would not permit them to bear arms to defend the country, Justice Douglas, speaking for the court in approving the views expressed by Hughes and Holmes and holding that such aliens were not barred from citizenship, succinctly stated: "The test oath is abhorrent to our tradition."

This basic principle was also discussed by Justice Jackson in the last of the "flag salute" cases where, in speaking for the court he said:

> But freedom to differ is not limited to things that do not matter much. That would be a mere shadow of freedom. The test of its substance is the right to differ as to things that touch the heart of the existing order.
>
> If there is any fixed star in our constitutional constellation, it is that no official, high or petty, can prescribe what shall be orthodox in politics, nationalism, religion, or other matters of opinion or force citizens to confess by word or act their faith therein.

At this late date it is hardly open to question but that the people of California in adopting Section 3 of Article XX also meant to include in our state Constitution that fundamental concept of what Chief Justice Hughes referred to as "freedom of conscience" and Justice Holmes called the "principle of free thought." Paraphrasing their words, we conclude that the people of California intended, at least, that no one could be subjected, as a condition to holding office, to any test of political or religious belief other than his pledge to support the Constitutions of this state and of the United States; that that pledge is the highest loyalty that can be demonstrated by any citizen, and that the exacting of any other test of loyalty would be antithetical to our fundamental concept of freedom. Any other conclusion would be to approve that which from the beginning of our government has been denounced as the most effective means by which one special brand of political or economic philosophy can entrench and perpetuate itself to the eventual exclusion of all others; the imposition of any more inclusive test would be the forerunner of tyranny and oppression.

It is a well-established principle of constitutional interpretation that the meaning of any particular provision is to be ascertained by considering the Constitution as a whole and that the duty of the court in interpreting the Constitution is to harmonize all its provisions. A strikingly analogous application of this principle of construction is found in West Virginia State Board of Education v. Barnette, where Justice Jackson said:

> In weighing arguments of the parties it is important to distinguish between the due process clause of the Fourteenth Amendment as an instrument for transmitting the principles of the First Amendment and those cases in which it is applied for its own sake. The test of legislation which collides with the Fourteenth Amendment, because it also collides with principles of the First, is much more definite than the test when only the Fourteenth is involved. *Much of the vagueness of the due process clause disappears when the specific prohibitions of the First become its standard* (italics ours).

In the problem of interpretation with which we are at present confronted, we find in the specific mandate of Section 9 of Article IX of our Constitution, providing that the University shall be entirely independent of all political or sectarian influence, a standard by which to decide the question of whether the petitioners herein are to be included within the term "office or public trust" as used in Section 3 of Article XX. It goes without saying that in the practical conduct of the affairs of the University the burden of so preserving it free from sectarian and political influence must be borne by the faculty as well as by the Regents. Hence, if the faculty of the University can be subjected to any more narrow test of loyalty than the constitutional oath, the constitutional mandate in Section 9 of Article IX would be effectively frustrated, and our great institution now dedicated to learning and the search for truth reduced to an organ for the propagation of the ephemeral political, religious, social, and economic philosophies, whatever they may be, of the majority of the Board of Regents of that moment.

It must be concluded that the members of the faculty of the University, in carrying out this most important task, fall within the class of persons to whom the framers of the Constitution intended to extend the protection of Section 3 of Article XX.

While this court is mindful of the fact that the action of the Regents was at the outset undoubtedly motivated by a desire to protect the University from the influences of subversive elements dedicated to the overthrow of our constitutional government and the abolition of our civil liberties, we are also keenly aware that equal to the danger of subversion from without by means of force and violence is the danger of subversion from within by the gradual whittling away and the resulting disintegration of the very pillars of our freedom.

It necessarily follows that the requirement that petitioners sign the form of contract prescribed in

the Regents' resolution of April 21, 1950, was and is invalid, being in violation both of Section 3 of Article XX and Section 9 of Article IX of the Constitution of the State of California, and that petitioners cannot be denied reappointment to their posts solely because of their failure to comply with the invalid condition therein set forth.

Subject to such reasonable rules of tenure as the Regents may adopt, the appointment and dismissal of professional personnel of the University is a matter largely within the discretion of the Regents. Nevertheless, in the event of proof of an abuse of discretion the "propriety of the remedy . . . is clear." Thus in the present case the imposition of the oath in question being violative of the applicable constitutional provisions, the abuse of discretion is clear, and hence this court may compel the reinstatement of petitioners to their respective positions.

In view of the foregoing it is unnecessary to consider the further contentions of petitioners that the resolution of July 21, 1950, constituted an irrevocable appointment of the petitioners, and that the action of the Regents constituted an arbitrary dismissal in violation of petitioners' tenure rights.

Therefore, since the letters of appointment issued to petitioners following the Regents' resolution of April 21, 1950, were subject to the condition that the petitioners sign letters of acceptance of appointment containing the affirmative statement, the requirement of which we have held to be invalid, it is the order of this court that the writ issue directing respondents by their secretary, respondent Underhill, to issue to each of the petitioners a letter of appointment to his regular post on the faculty of the University, which appointment shall not be subject to the aforementioned invalid condition. Provided that, if any of petitioners has not yet executed the constitutional oath of office as provided in the said resolution of April 21, 1950, the respondents may require that such petitioner, as a condition precedent to his appointment, execute said constitutional oath.

Let the writ issue.

THE following resolution on the University of California "oath" was passed at the annual meeting of The American Physiological Society on May 2, by a ratio of 4:1.

RESOLUTION: The American Physiological Society, the professional organization of physiologists in this country, expresses its deep satisfaction with the decision of the Appellate Court of California (Third District) entitled, "Concerning the Special Loyalty Declaration of the University of California." It feels justified in so commenting on a judicial matter because of the explicit and wise recognition by the Court of the issue of academic freedom and of the overriding importance of such freedom for the continued intellectual health of educational institutions and of the communities they serve.

The Society further urges its members, if offered appointment at the University of California, to accept only when convinced that the Board of Regents is prepared to function in accord with the tradition of academic freedom long established at this outstanding institution.

Technical Papers

Methonium Halides in High Blood Pressure

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Penta- and hexamethonium halides were found by Paton and Zaimis (*1*) to reduce the blood pressure in lower animals. Organe *et al.* (*2*) and Arnold and Rosenheim (*3*) observed the same effect in man. Paton and Zaimis (*4*) found that this reduction in blood pressure was due, in part at least, to inhibition of autonomic ganglia. The blood pressure fall varies with posture, the magnitude of the fall increasing as the subject becomes more nearly vertical. Restall and Smirk (*5*) showed that administration to high blood pressure patients of two or three subcutaneous injections of penta- or hexamethonium halides daily makes it possible, without adverse symptoms, to secure a more substantial reduction of the blood pressure than has ordinarily been practicable hitherto. Repeated administration induces tolerance; the initial dose of 15 mg therefore has to be increased, sometimes to as much as 200 mg.

Using an electrically driven syringe, selected doses of hexamethonium bromide have been administered by slow subcutaneous injection over a 24-hr period. By refilling the syringe daily the period of continuous subcutaneous injection has been extended to 10 or more days. By this means the blood pressure of severe hypertensives (say, 260/150) has been maintained in many instances at approximately normal levels (say, 130/90) day and night for 10 days or more. Unmistakable and rapid clinical improvement, particularly with the continuous injection, gives support to the view previously expressed (*6*) that the high blood pressure is a link in the chain of causes that lead to the signs and symptoms of essential hypertension by

overstrain and damage of the heart and of blood vessels in various parts of the body.

In successive collaboration with Restall (*5*) and Alstad (*7*) the effects of test doses were studied in 170 patients, and treatment of 1–16 months' duration has been in progress in 68 patients, including hytertension of the malignant, essential, renal, and postpregnancy toxemic types. It is clear that blood pressure reduction can be obtained in hypertension cases, irrespective of the etiology, and also in normal controls. Clinical details of improvement in papilledema, retinal edema, retinal hemorrhages, headache, encephalopathic and dizzy attacks, general congestive heart failure, left ventricular failure, and exercise capacity are given elsewhere (*5, 7–9*).

The observations on normal subjects give direct evidence that the factors responsible for maintaining normal blood pressure levels are influenced by the drugs. In severe hypertensives the effect of a methonium injection may be sufficiently great to reduce the blood pressure by as much as 140 mm Hg systolic and 80 diastolic, which reduction is of the same order as the entire normal blood pressure (120 systolic, 75 diastolic). Hence it seems that the pathological fraction of the high blood pressure in essential hypertension is also reduced by methonium halides.

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A Test of the Infrared Absorption Theory of Olfaction

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Beck and Miles (*1*) have proposed an ingenious explanation for the sense of smell, based on differential radiation losses by the receptors responsible for the function. According to their theory, these receptors radiate and absorb selectively as a result of their size and shape, and when a substance with an absorption band in the appropriate region (8μ–14μ) enters the nasal passages a transient loss of heat will occur, resulting in the perception of smell. Beck and Miles substantiated this theory by experiments performed on certain insects ideally suited for the purpose because of their external olfactory receptors. The difficulty of performing their experiment—i.e., the illumination of the olfactory receptors with radiation passing through an odorous vapor—on humans or mammals in general led us to seek an indirect confirmation of the theory.

A gas in an opaque chamber will approach temperature equilibrium with the walls, a state in which the radiation absorbed and that emitted by the gas are of identical nature. If an odorous gas were enclosed in an opaque chamber at body temperature for a sufficient length of time to come to equilibrium with the chamber walls, and then inhaled through an opaque tube, also at body temperature, the radiation to the walls of the nasal passages would be unchanged. If the theory of Beck and Miles, as interpreted above, is correct, no sensation of smell would be produced, whereas according to the old explanation based on a chemical reaction induced in the nasal passages, the smell would be relatively unaffected by the temperature of the gas.

In an experiment involving this principle, the sensation of smell showed no evident dependence on the temperature of the gas inhaled. The procedure was to submerge a collapsible rubber bag, the connecting rubber tube, and the observer's head, with a small attached diving mask, in a reservoir of temperature-controlled water. Air mixed with vapor of cloves in the rubber bag was inhaled by the observer after he had remained submerged for several minutes, during which time breathing took place through a separate tube. It was calculated that temperature equilibrium for the gas and equipment should have required about 20 sec. A range of temperatures from 36.7° to 42.4° C in approximately 0.5° steps was used. Calculations showed that any cooling of the gas because of expansion while inhaling had a negligible effect.

A second related experiment required no special equipment. In this test the vapor of cloves was inhaled through the mouth, held in the lungs for 15 sec or more, and exhaled slowly through the nose. The odor of cloves was easily discernible in the exhaled vapor despite the fact that the vapor was very close to body temperature.

The failure of these experiments to yield any pronounced disappearance in sensation of smell when the vapor was at body temperature does not necessarily exclude infrared absorption as the basis of olfaction in humans. It becomes necessary, however, to assume that inside the nasal passages there are temperature differences resulting in a sensation roughly independent of the temperature of the gas as it enters the nose. Should this prove untenable, it may be necessary to return to the chemical theory of olfaction for mammals.

An experiment similar to that Beck and Miles performed on insects might be performed on humans. If a sealed tube of material transparent to the 8μ–14μ region, and containing an odorous gas, could be inserted into the nasal passages, the ability or failure to smell this gas would be conclusive evidence for or against the infrared theory.

Addendum. Since the submission of this manuscript for publication, Lloyd H. Beck suggested in a private communication that phenyl ethyl alcohol would have

been a much better substance to use than cloves, which is detected through its pungency. Accordingly, Milton F. Metfessel, of the Psychology Department, and the senior author repeated the experiment on olfactory identification during exhalation, using β-phenyl ethyl alcohol, a substance that smells very much like roses.

Although a mere trace of the substance in a room produces a strong fragrance, under the conditions of the experiment most subjects (5 of 7) reported only a faint or transitory smell, and the others (with which Forrester's sensations agreed) were conscious of a strange sensation which, as one of the observers said, was "not a smell exactly." These results may, perhaps, be explained by the rapid adaptation that occurs for strong doses of the substance.

A positive check on the theory may have to await a test of the type suggested above, and Metfessel and Forrester are investigating its practicability.

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The Potentiation of DDT against Resistant Houseflies by Several Structurally Related Compounds

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The discovery of a potent synergist for DDT against DDT-resistant insects would provide a means of controlling such insects in the field (especially the housefly) and might be helpful in elucidating the mechanism of resistance.

Claims have been made that at least three quinones (*1*), two fluorinated DDT-analogs (*2*), octachloro-4,7-endomethylene-tetrahydrohydrindine (*2*), several halogenated phenols (*2*), some 2,4-dinitrophenols (*3*), three diaryl sulfides (*4*), and sabadilla (*5*) promote and extend the toxicity of DDT toward certain insects. More recently, Perry and Hoskins (*6*) reported a marked increase in effectiveness of DDT-piperonyl cyclonene (the latter in considerable excess) against DDT-resistant houseflies, but not against susceptible strains.

Most of the synergists listed above were tested in this laboratory at a 1 : 10 ratio with DDT against DDT-resistant houseflies and were found to be weakly or only moderately active. This appears to confirm the observation of Perry and Hoskins (*6*) that the DDT-resistance of houseflies depends on one or more biological factors not encountered in the normal fly.

It is possible that the mechanism of DDT-resistance developed by the insect could be interrupted by a compound structurally related to DDT, and more especially by an analog which shared a good measure of its physical properties. In fact, this is borne out by the fair degree of synergistic activity provided for DDT by its *p,p'*-difluorine analog, 2,2-bis(*p*-fluorophenyl)-1,1,1-trichloroethane (*2*). It therefore appeared worth while to test a series of DDT analogs, both with and without insecticidal activity, for their synergistic effect toward DDT, with especial reference to field strains of resistant flies. This is the first report of an investigation of this series of compounds for their synergistic activity.

The selected compounds, listed in Table 1, were tested as synergists for DDT by dissolving 125 mg of each separately in 25 ml of a 5% solution of DDT in methyl ethyl ketone. This solution was pipetted on a poster board surface at the rate of 200 mg DDT and 20 mg of candidate synergist per sq ft. (Conventional glass panels could not be used in these tests because of the failure of the DDT-synergist combinations to crystallize adequately even with waiting and stroking.) The solvent was allowed to evaporate, and test lots of approximately 40 wild DDT-resistant flies were held in contact with the deposits in Petri-dish wall cages (*7*) for a period of 2 hr. The flies then were removed and held under optimum conditions for recovery for a period of 24 hr. Mortality counts were made, and the percentage kills of female flies are given in Table 1.

1,1-bis-(*p*-Chlorophenyl)-ethanol is the outstanding compound among those under test, as judged on the basis of its consistent performance in the individual

TABLE 1

Twenty-Four Hour Mortality of Wild Female DDT-Resistant Houseflies Following a 2-hr Exposure to a Deposit Composed of DDT (200 mg/sq ft) and a Candidate Synergist (20 mg/sq ft) on a Poster Board Surface

No.	Synergist	Ratio of percentage mortality*
1	2,2-bis-(*p*-Chlorophenyl)-1,1,1-tribromoethane	10/1, 16/17
2	2,2-bis-(*p*-Chlorophenyl)-1,1-dichloroethane	14/7
3	1,1-bis-(*p*-Chlorophenyl)-ethanol	89/0, 63/7, 80/11
4	1,1-bis-(*p*-Chlorophenyl)-2,2,3-trichlorobutane	4/7
5	2,2-bis-(*p*-Fluorophenyl)-1,1,1-trichloroethane	11/7, 10/0
6	2,2-bis-(*p*-Bromophenyl)-1,1,1-trichloroethane	3/7
7	2,2-bis-(Phenyl)-1,1,1-trichloroethane	18/7
8	2,2-bis-(*p*-Ethylphenyl)-1,1,1-trichloroethane	10/7
9	2,2-bis-(*p*-Hydroxyphenyl)-1,1,1-trichloroethane	6/17, 3/1
10	2,2-bis-(*p*-Ethoxyphenyl)-1,1,1-trichloroethane	3/1, 34/17
11	1-(*p*-Chlorophenyl)-2,2,2-trichloroethanol	9/7, 8/0

* The numerators in these ratios are the average percentage kills produced by replications of the DDT-synergist combination on a single day. The denominators are the average percentage kills produced by DDT alone in a comparable number of replications. The multiple ratios were obtained by repeating the tests on more than one day.

tests and the relative potency of its combination with DDT. This compound, which has been advanced as a miticide under the name *p,p'*-dichlorodiphenyl methyl carbinol (DMC), is the active ingredient of the proprietary product "Dimite" (*8*). The potency of DMC, coupled with its availability, prompted additional tests. The carbinol was mixed with DDT in varying proportions and tested under the conditions described above. The results are shown in Table 2.

TABLE 2

TWENTY-FOUR HOUR MORTALITY OF WILD FEMALE DDT-RESISTANT HOUSEFLIES FOLLOWING A 2-HR EXPOSURE TO DDT-DMC DEPOSITS ON A PAPER BOARD SURFACE

Test No.	Toxicant	Concentration (mg/sq ft)	Average mortality (%)	Replications
1	DDT	200	6	9*
2	DDT DMC	200 2	15	3
3	DDT DMC	200 20	78	7†
4	DDT DMC	200 25	73	2
5	DDT DMC	200 40	87	2
6	DDT DMC	200 100	83	2
7	DDT DMC	200 200	76	5‡
8	DDT DMC	20 200	2	3
9	DMC	200	0	3

* Replications made over a period of 25 days.
† " " " " " " 21 " .
‡ " " " " " " 4 " .

The synergistic effect of DMC on DDT was evidenced at the dosage level of 1 part DMC to 100 parts DDT. Very high kills were obtained from a combination of 100 parts DDT and 10 parts DMC, but the latter mortality rates were not raised appreciably by increasing further the proportion of DMC up to 50% of the mixture. Very low kills of houseflies were obtained from a deposit composed of 100 parts DMC and 10 parts DDT, the same dosage level at which the reverse combination is quite toxic. DMC alone gave no mortality among female houseflies.

The enhanced activity of the DDT-DMC combination is further pointed up by the fact that the following combinations were highly toxic to DDT-resistant flies: (*a*) DDT with 1,1-bis(*p*-fluorophenyl)-ethanol; (*b*) 2,2-bis(*p*-fluorophenyl)-1,1,1-trichloroethane with DMC; and (*c*) 2,2-bis(*p*-fluorophenyl)-1,1,1-trichloroethane with 1,1-bis(*p*-fluorophenyl)-ethanol. The last combination was the most effective of the three.

In preliminary field tests, a residual application of 200 mg DDT and 40 mg DMC failed to give lasting results against a highly resistant strain of flies at a dairy near Savannah. However, in limited field tests of outdoor mist space sprays against the same highly resistant houseflies, a water emulsion of 5% DDT and 1% DMC has given results approaching those originally obtained with DDT against nonresistant flies.

Preliminary experiments indicate that some DDT-DMC combinations may be more toxic to white rats on an acute oral basis than either compound alone. The breadth and mechanism of the synergistic effects of DMC on DDT in both insects and mammals are under investigation in both the laboratory and the field.

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Submarine Canyons: A Joint Product of Rivers and Submarine Processes[1]

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The abandoned sea-level-lowering hypothesis. This note is written in the hope that the writer will not continue indefinitely to be tied to the now long-discarded hypothesis that submarine canyons are the result of a lowering of sea level amounting to several thousand feet, which was thought to result from the formation of huge ice caps. This hypothesis was offered as a somewhat forlorn hope that seemed, at the time, to be the only way out of an enigma. Discoveries of the past few years have indicated that no such great lowering took place during the Pleistocene. The large submergences indicated by a considerable series of oceanographic discoveries appear to be more remote in age and to have, therefore, no relation to glacial control. Despite recent articles (*1*) and talks given before scientific societies during the past two years it has proved most difficult to bury the old hypothesis. In offering an alternative explanation with little amplification it should be noted that a much longer article is being prepared. This will give a complete account of the basis for suggesting still another origin for the much-abused submarine canyons.

A new composite hypothesis. New oceanographic information can now be combined with information from drill cores along the coasts and on islands to build a composite hypothesis that accounts for submarine canyons without appealing either to enormous movements of land or of sea level or to the excavation by powerful submarine currents for which there is no

[1] Contribution from the Scripps Institution of Oceanography, New Series No. 524.

evidence. It now appears that many of the canyons have three divisions as follows:

1. Inner valley heads that extend into shallow water along many coasts and contain indications of having been cut at a relatively recent period.

2. Intermediate canyons that have rocky walls rising hundreds or even thousands of feet above their narrow, winding floors.

3. Outer valleys, only slightly incised into great masses of unconsolidated sediment, which can be traced out to the base of the oceanic slopes.

These three divisions are not clearly separated one from the other and apparently have had a composite and overlapping origin. The outer two divisions can be explained by a sequence of events that fits into a pattern well known to geologists who have investigated the history of depositional basins (geosynclines). The submergence of a geosyncline is known to alternate with reversals of movement. Similarly, the deep submergence of the continental margins, which is thoroughly established from well records along many of the present coasts, was probably interspersed with stages of uplift or preceded by an uplift. During uplifts, the exposed continental margin was trenched by stream erosion, thus forming the intermediate canyons. Outside these canyons deltas developed on the lower oceanic slopes.

Following the cutting of the canyons, the slopes were submerged. The canyons became a locus of intensive deposition, but wherever they had high gradients the sediment was carried outward by submarine landslides such as are now well established as occurring in the canyons along the California coast. The soft sediments of the deltas are thought also to have undergone mass sliding movements, opening up cracks and scars on the delta fronts. One of the results of the slides was the development of turbidity (density) currents which transported the sediments down the canyon floors (*2*) and, moving across the deformed deltas, sank into the landslide scars and cracks, gradually transforming them into valleylike features. These "valleys" were eventually extended to the base of the continental slopes.

As submergence continued, deposits were formed in many places on the old surfaces into which the canyons had been cut. These deposits built up shelves such as those on the east coast of the U. S., but failed to eliminate the canyons because of the continuing landslides. Slides probably also took place on the continental slopes. In this way the canyons have walls that have grown upward as a result of deposition as the canyon floor sank.

During the glacial period, which lasted approximately one million years, the canyon heads were alternately exposed and submerged as the result of changing sea levels. During each glacial stage of lowered sea level the streams from the land have tended to flow into the heads of the canyons and have extended these heads farther in toward the present coasts. It is probably this stream erosion during glacial stages that accounts for the fresh appearance of canyon heads in shallow water (*3*).

The history of canyon development has been different in different areas. For example, in some regions, such as in Monterey Bay, California, the middle zone of the canyons extends far deeper than in most other areas, and the movements of both uplift and sinking appear to have been much greater. The upbuilding of the shelf during submergence has been very great along the northeast and Gulf coasts of the United States, but south of Cape Hatteras the shelf has apparently not been covered with sediment as it sank, with the result that the deep Blake Plateau represents a submerged shelf swept clean by bottom currents.

Evidence for the new hypothesis. The sequence of events described here is not a purely philosophical concept built up to explain a very puzzling situation, as some of the preceding hypotheses have been; it is built on a substantial and rapidly growing foundation of facts from marine investigations and from drill core loggings. A brief summary of the evidence, which will appear in full later, follows.

1. The inner canyons, where studied in detail (off La Jolla, off Carmel, and off the French Riviera), have an extraordinary resemblance to adjacent stream-cut canyons; that is, they have winding courses, branching tributaries, rock gorges with precipitous walls, and even terraces on the side.

2. There are many lines of evidence to support the contention of great submergence along the continental borders and in oceanic island masses. Deep wells along some of the coasts of the continents show that shallow water, or even terrestrial deposits, extend for thousands of feet below present sea level. Wells that significantly bear out these contentions have been drilled on Cape Hatteras and the Mississippi delta, the two points in the U. S. where deposition has extended the land out across the greater part of the continental shelf. Numerous other wells along the east and south coasts of the U. S. add confirmation, as do some well records of coastal California. Similar results come from wells drilled into oceanic islands, like Bikini (*4*). Rounded cobbles, indicative of wave action in shallow water, are found widespread on the banks and seamounts outside the continental slopes. Fossil evidence reported by R. S. Dietz, Maurice Ewing, and most recently by Roger Revelle indicates that these banks were covered only with shallow water at a time that probably preceded the ice age by many millions of years.

3. Channels similar to those found on steep delta fronts are found outside the rock canyons along the southern California coast, and these channels extend down the sides of bulging masses indicative of ancient deformed deltas.

4. There is no present evidence that either slumping or mud-laden currents are capable of excavating great rock-walled canyons like those on the sea floor. In fact, the steep fronts of deltas built into lakes in the Alps are known to be building out rather than having canyons cut into them.

5. The slight depressions in the fronts of lake deltas probably represent localities where currents or slides

have locally slowed the forward advance of the delta. These channels have little in common with the rock gorge type of submarine canyons but resemble the outer shallow valleys that form an extension of the submarine canyons.

6. Virtually all the arguments now being used for subaerial origin are based on the hypothesis of great lowering of sea level during the ice ages, an idea that was abandoned more than two years ago.

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Maleic Hydrazide as an Antiauxin in Plants[1]

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In the first report of the action of maleic hydrazide on plants, Schoene and Hoffmann (*1*) demonstrated that this compound inhibited stem elongation and overcame the normal apical dominance in tomato plants. The same responses have subsequently been observed in many other plant species.

Growth inhibitors in general do not cause lateral buds to develop. However, one agent that does inhibit stem elongation and that breaks apical dominance is x-irradiation (*2*), and, interestingly enough, x-irradiation also causes the destruction of indoleacetic acid or auxin (*3*). Auxin is essential for growth and is apparently the controlling factor in apical dominance. The possibility suggests itself, then, that maleic hydrazide may act within the plant in opposition to auxin, i.e., as an antiauxin.

If maleic hydrazide does act as an antiauxin, it would be logical to expect it to inhibit growth where auxin is limiting, and that this inhibition should disappear when auxin is not limiting. This has indeed been found to be the case.

Using the standard slit pea test (*4*), initially inhibitory levels of maleic hydrazide were added to serial concentrations of auxin. The results were collected using the stem-reference technique of Thimann and Schneider (*5*). In typical data from such an experiment (Table 1) two salient features can be seen: (1) Maleic hydrazide at both the concentrations used (3 and 10 mg/l) inhibits growth in the presence of low concentrations of auxin (.01 and 0.1 mg/l indoleacetic acid). For example, referring to Table 1, maleic hydrazide inhibition in 0.1 mg/l auxin amounts to −118° and −126°, respectively, for the two inhibitor concentrations. These differences are both significant at the 1% level. (2) Maleic hydrazide at these same concentrations does *not* inhibit growth in the presence of high concentrations of auxin (10 and 100 mg/l indoleacetic acid). Thus the differences between the auxin controls and the maleic hydrazide treatments amount to +9 and −9°, −7° and +17°, respectively, for the two inhibitor concentrations. These differences do not approach significant levels.

TABLE 1

INHIBITION OF GROWTH BY MALEIC HYDRAZIDE AND ITS REVERSAL WITH HIGH CONCENTRATIONS OF INDOLEACETIC ACID
(Slit pea test, 17 hr; readings made by stem-reference method.)

IAA conc (mg/l)	Curvature without MH (degrees)	Curvature with 3 mg/l MH (degrees)	Difference due to added MH (degrees)	Curvature with 10 mg/l MH (degrees)	Difference due to added MH (degrees)
None	−227	−239	− 12	−242	− 15
.01	−135	−168	− 33	−231	− 96*
0.1	− 13	−131	−118†	−139	−126†
1.0	162	152	− 10	122	− 40
10	337	346	9	330	− 7
100	−125	−134	− 9	−108	17

* LSD at 5% level: 76°.
† LSD at 1% level: 101°.

The capacity of auxin to overcome maleic hydrazide inhibition completely is reproducible over a wide range of concentrations of the inhibitor, and has been confirmed using two other growth tests: the pea straight growth test and the *Avena* straight growth test. Indoleacetic acid is not the only growth regulator capable of relieving maleic hydrazide inhibition. The same effect has been observed using naphthaleneacetic acid as the growth regulator.

Maleic hydrazide inhibition is not evident in the data in Table 1 in the treatment using no auxin. In the tests we have carried out it has been generally true that where conditions did not permit much growth maleic hydrazide inhibition was greatly reduced. In cases where growth is more active, however, maleic hydrazide inhibition is much more severe. This can be seen readily from Table 1 in the treatments using 0.01–0.1 mg/l of auxin.

The ability of maleic hydrazide to act as an antiauxin will be discussed in more detail in another paper (*6*). It is clear, however, that maleic hydrazide inhibition can be overcome by the addition of excess auxin, and hence it may properly be called an antiauxin.

Several other compounds capable of antagonizing auxin action have been described. Triiodobenzoic acid (*7*), unsaturated lactones such as coumarin (*8*), and 2,4-dichloroanisole (*9*) all have been demonstrated to antagonize auxin action. However, they have not been shown to be counteracted by the addition of more auxin, and work in our laboratory has failed to demonstrate such a characteristic in the first two of these. Hence it would seem that they act in a different manner than does maleic hydrazide.

One other antiauxin has been described which is

[1] Journal Paper No. 513, Purdue University Agricultural Experiment Station, Lafayette, Ind.

counteracted by auxin, namely *trans*-cinnamic acid, which was shown by van Overbeek (*10*) to have this interesting characteristic. Apparently its activity comes from its being an isomer of a compound showing growth-regulator activity. Maleic hydrazide, however, must not derive its activity in such a direct manner, because it has no side chain or acid group such as are required for growth regulators (*4*).

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A Qualitative Analysis of Capsular Polysaccharides from *Cryptococcus neoformans* by Filter Paper Chromatography

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The technique of filter paper partition chromatography (*1*) has been shown to provide a convenient method for the determination of sugars present in a mixture (*2*) or of monosaccharide components of polysaccharides following hydrolysis (*3*).

This procedure has been applied to a qualitative analysis of the capsular polysaccharide which numerous investigators (*4–10*) have isolated from the pathogenic yeast, *Cryptococcus neoformans*. Aside from general qualitative chemical tests for carbohydrates, there have been no studies on the chemical composition of this polysaccharide.[3]

A representative polysaccharide was chosen from each of the three antigenic types (A, B, and C) of *C. neoformans* (*5, 11, 12*). The polysaccharides were isolated from neopeptone dialysate broth cultures by alcohol precipitation. Details of the method used for purification are presented elsewhere (*5*).

Twenty-mg samples of each polysaccharide were hydrolyzed in 0.5 ml 1 *N* H_2SO_4 for 2.5 hr at 100° C. Neutralization of the hydrolysate was then effected by slowly adding solid barium carbonate. The precipitate was removed by centrifugation, and the supernatant fluid was applied to filter paper sheets for the analysis.

In performing the tests, strips of Whatman No. 1 filter paper 17.5 cm × 30–40 cm were employed for descending chromatograms. The lower end of each sheet was cut to a point to facilitate drainage of the solvent (*13*). Two solvents were employed with this method, *n*-butanol saturated with acetic acid (10%) and water (50%), as described by Partridge (*2*); the second solvent was ethyl acetate containing acetic acid and water in a 3 : 1 : 3 mixture (*13*).

TABLE 1

Relative Migration Distances (R_F and R_X Values) for Hydrolyzed Polysaccharides and for Reference Monosaccharides Using 4 Different Solvents

Reference monosaccharides and hydrolyzed polysaccharides	Solvents			
	Ethyl acetate (R_X)	*n*-Butanol (R_X)	Acetone (R_F)	Phenol (R_F)
D (+) xylose	1.00	1.00	0.67	0.47
L (−) fucose	1.07	1.22	0.68	.65
L (−) rhamnose	1.12	1.34	—	.61
D (−) ribose	1.11	1.16	0.72	.62
L (+) arabinose	0.95	0.90	.62	.56
D (+) galactose	.70	.71	.48	.46
D (+) glucose	.73	.77	.53	.42
D (+) mannose	.79	.86	.58	.51
D (−) fructose	.85	.88	.58	.55
D (+) glucosamine HCl	*T**	.69	*T*	.63
D (+) galacturonic acid	.67	.47	.15	.13
D (+) glucuronic acid	0.68	0.46	0.20	0.12
Type A hydrolyzed polysaccharide	1.00 0.79 0.70	1.00 0.86 0.71 0.44	0.67 0.48 *T*	0.51 0.47 *T*
Type B hydrolyzed polysaccharide	1.00 0.79 0.70	1.00 0.86 0.71 0.44	0.67 0.49 *T*	0.51 0.47 *T*
Type C hydrolyzed polysaccharide	1.00 0.79 0.70	1.00 0.86 0.71 0.44	0.67 0.49 *T*	0.51 0.47 *T*

* *T* = trailing spot for which no value was calculated.

On a pencil line drawn across the paper 2.5 cm from the edge of the trough, spots of the polysaccharide hydrolysates were placed with a micropipette calibrated to deliver 4 µl. Spots of the hydrolysates and spots of known reference sugars were placed along the line at intervals of 2 cm. The concentration of the hydrolysates was increased by adding a spot, allowing it to dry, and applying another spot at the same point. The sugars employed for reference are indicated in Table 1.

The filter paper strips were irrigated with solvent

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[3] Subsequent to the writing of this manuscript, personal communication with E. Drouhet and G. Segretain (*4*) has disclosed that they have recently submitted a paper in which it was shown that xylose, mannose, and a uronic acid were present in the polysaccharide with which they are working.

in the usual manner (*1, 2, 13*). Trial chromatograms with *n*-butanol disclosed that excellent separation of sugar spots was obtained in 36–48 hr. This time was adjusted so that the most rapidly migrating sugar remained well above the lower end of the chromatogram. The papers irrigated with ethyl acetate were allowed to run for 24–30 hr. After irrigation, the solvent was removed from the chromatograms by evaporation in a circulating air oven at 85° C. The sugar spots were located by spraying with the silver nitrate reagent of Partridge (*2*) and developing in an oven at 85°–95° C.

Since the solvent was allowed to flow off the end of the paper it was not possible to calculate the R_F value (*2*). Instead, the value "R_X" was used. With this system, xylose was arbitrarily assigned a migration distance of 1.00, and the location of the other sugar spots was calculated proportionally.

Two additional solvents were employed in an ascending chromatographic method, the phenol-ammonia mixture of Partridge (*2*) and commercial acetone to which 10% water by volume was added. In these chromatograms, the filter paper sheets were rolled into cylindrical form and allowed to irrigate by the ascending technique of Williams and Kirby (*14*). Five to eight hours were sufficient for migration of the acetone and 10–12 hr for the phenol. Development of the spots was conducted as with the other solvents. R_F values were calculated for these chromatograms by the usual method (*2*).

The separation of the components of the hydrolysates was not equally good with all the solvents. Results with the *n*-butanol and ethyl acetate were more satisfactory than with the other two solvents. This was partly due to the better separation possible with the modified descending technique (*13*) used with the *n*-butanol and ethyl acetate.

An examination of the R_F and R_X values in Table 1 reveals that the polysaccharides of all three types exhibited spots migrating similarly to xylose, mannose, and galactose.

In chromatograms irrigated with butanol, mannose was differentiated from fructose by spraying with a resorcinol-HCl mixture (*15*). The fructose control produced a bright red spot when this reagent was employed, but the mannose spot was barely visible.

Each hydrolysate possessed an additional slower-moving spot in the region of galacturonic acid and glucuronic acid. This spot did not coincide exactly with either of the two reference uronic acids, however, and since additional uronic acids were not available the spot has not been identified. It seems likely that this spot represents the uronic acid responsible for positive Dische tests (*4, 5*). The uronic acid spot was well isolated only with the butanol-acetic acid mixture. It formed a trail when phenol and acetone were employed as solvents.

The hydrolysates of polysaccharides from each of the three antigenic types of *C. neoformans* are qualitatively similar. The fact that all three polysaccharides contain the same four monosaccharides offers some insight into the close antigenic relationships among the three types (*5, 11, 12*).

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The Relationship of Muscle Potassium to the Melanophore-concentrating Effect of Pressure on the Trout[1]

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Observant fishermen have noted that not only do trout lose their brillant coloring at varying intervals of time after being taken from the water but also that the pallor is often patchy and occurs principally at points of pressure. The patterns of leaves or ferns used for packing the creel are frequently sharply outlined on the trout's skin. Fish kept for relatively long periods tend to become uniformly pale. This latter type of pallor is very likely due to the melanophore-concentrating effect of temperatures above those to which the trout is accustomed (*1*). That caused by pressure has not been explained satisfactorily. The only investigator who has apparently paid any attention to this phenomenon is von Frisch (*2*). He concluded that concentration of the melanophores from pressure was due to the local accumulation of acid products of metabolism. The experimental findings outlined in the present communication point to another mechanism.

Observations on the effects of pressure applied to the body surface of the trout under varying conditions have been described in a previous study (*1*). The salient findings were as follows:

1. A rainbow trout (*Salmo gairdnerii*), killed instantly by a sharp blow on the head and laid on a hard surface, exhibited pallor of the underside within 20–30 min. Turning the fish over resulted in a gradual dispersion of the concentrated melanophores, and those of the side now underneath concentrated. This reversal phenomenon, dark to pale and pale to dark, could be induced repeatedly. Pallor from pressure

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was inhibited by lowering the surface temperature sufficiently. The duration of pressure rather than the intensity appeared to be the important factor.

2. Pressure on strips of skin isolated from the body produced no change in the state of dispersion of the melanophores contained therein. However, when pressure was applied to excised blocks of tissue consisting of skin and underlying muscle, concentration of the melanophores occurred just as if the tissue were still a part of the dead fish. This suggested that pressure brought about the transfer of some melanophore-concentrating substance from the muscle or subcutaneous tissues into the skin.

3. Strips of skin removed from the trout and replaced on the subcutaneous tissue showed no effect from applied pressure. The result was quite different, however, when a skin strip was laid on exposed muscle. Marked melanophore concentration and pallor took place within a minute or two. Extracts of the dead trout's muscle made by maceration in 0.9% NaCl solution were equally effective.

4. That pressure-induced pallor was not simply a post-mortem effect was shown by placing a rubber band around the live trout. Its removal after 45 min revealed a band of pallor encircling the fish's body.

5. Evidence that living muscle is capable of liberating a melanophore-concentrating substance was obtained by laying a strip of skin (from another trout) on the exposed muscle of a live trout with its head kept under water during the procedure. Concentration of the melanophores of the skin strip at points of contact with the muscle was just as rapid as when muscle of dead trout was employed.

Of the known substances in muscle that possess the power to produce concentration of melanophores—namely, potassium and calcium—the former exhibits considerably greater activity in this respect (*1*) and is very much more abundant than calcium. Furthermore, since potassium constitutes by far the predominant base of muscle, it is unlikely that any other ion (e. g., magnesium) could be responsible for this effect. Determinations were made of the potassium content of trout muscle (freed from fat) and of extracts (equal parts by weight of muscle and 0.9% NaCl solution, ground in a mortar) in order to ascertain whether the concentrations of potassium present were sufficient to produce the degree of melanophore contraction described. Trout muscle was found to contain 129 mEq potassium/kg muscle, which is a relatively high figure for vertebrate muscle. The muscle extract contained 66 mEq/kg fluid,[2] which in terms of KCl would equal 0.49% solution. It was found in the previous study that 0.8% NaCl was required to neutralize the melanophore-contracting effect of 0.1% KCl. Actual tests with 0.5% KCl showed that even 2% NaCl, which by itself produces a marked dispersion of the melanophores, when added to the KCl solution did not prevent the contracting effect of the potassium. Another pertinent observation of the earlier study was that the potassium ion is able to penetrate rapidly the subcutaneous surface of the isolated skin strip.

Although these findings made it evident that release of potassium from the trout's muscle could account for the above-described effects on the melanophores, they did not exclude the possibility that the contracting agent might be an organic compound. To elucidate this point the following procedures and tests were carried out. Muscle extracts dialyzed through cellophane bags were found to have lost their activity for melanophores. Although this would eliminate organic compounds of large molecular weight, such substances as adrenalin are readily dialyzable (*3*). On the other hand, boiling extracts and keeping them in an unsterile state for 2 weeks did not reduce their potency. As a further, and crucial, procedure a muscle extract was incinerated, water was added, and the H-ion concentration adjusted to bring it back to its original volume and reaction (pH 8.0). This reconstituted extract exhibited fully as great melanophore-contracting activity as did that part of the same extract kept untreated as a control; hence there seems to be no doubt that the active principle is an inorganic compound.

Further studies showed that slices of trout brain, liver, and spleen, tissues known to be relatively rich in potassium, all possessed the property of producing contraction of the melanophores of skin strips. Fresh beef muscle also exhibited the same effect, whereas blood serum, which contains approximately 5 mEq potassium/l, and a ratio of Na to K of about 30:1, caused no change in the state of the pigment cells. These findings add support to the probability that the melanophore concentration and attendant pallor of the trout's skin resulting from pressure are due to liberation of potassium from the underlying muscle.

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Fluorometric Determination of Nicotinamide by Use of Synthetic Ion Exchange Resins

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Chaudhuri and Kodicek (*1*) have reported a fluorometric determination of nicotinamide by treatment with cyanogen bromide solution under specified conditions. In that case, interferences of the other fluorescent substances were practically eliminated by the use

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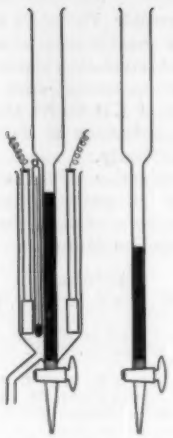

FIG. 1. Exchange tubes (col diam, 7 mm). Tube A, left, KH-4B-Na; tube B, right, Amberlite IRA-400-OH.

of acid and alkaline pretreatment and a special blank, but complete elimination of the interferences was not performed by the method.

We have found that fluorescences caused by kynurenine, 3-hydroxykynurenine, and the other unknown substances in the silkworm *Bombyx mori* cannot be eliminated by the usual methods, but they can be eliminated completely by successive purification with carboxylic-type cation exchange resin KH-4B (*2*) and strong-base–type anion exchange resin Amberlite IRA-400 (*3*).

Reagents used:

Synthetic cation exchange resin KH-4B (Oda Laboratory of Kyoto University).

Synthetic anion exchange resin Amberlite IRA-400 (Rohm & Haas Co.); 25% metaphosphoric acid solution, freshly prepared at the time of using.

CNBr solution, freshly prepared just before the experiment by adding ice-cold 10% aqueous NaCN solution by drop to ice-cold saturated bromine water until it is just decolorized.

KH_2PO_4-NaOH buffer solution (pH 7).

5% NaCl solution (pH 5).

0.2*N* NaOH-N KCl.

1*N* NaOH and 15% NaOH solution.

0.1*N*, 1*N*, 5*N* HCl.

Standard nicotinamide solution (5γ/ml), prepared weekly from a stronger nicotinamide solution.

Apparatus. Two exchange tubes (Fig. 1) are used for purification of the extract solution. Tube A, filled with 1 g KH-4B, is used for removal of interfering cations, and Tube B, filled with 3 ml Amberlite IRA-400, is used for removal of interfering anions.

Tube A is treated with 100 ml hot 0.2*N* NaOH-N KCl at the rate of 1 ml/min, 100 ml hot distilled water at the rate of about 20 ml/min, 200 ml hot 5% NaCl solution (pH 5) at the rate of 3 ml/min, and then 100 ml hot distilled water at the same flow rate. The jacket is used to maintain temperature of the resin bed at 80°–85° C throughout these pretreatments. Tube A is then treated with 70 ml cold distilled water without the use of the jacket, at the rate of about 20 ml/min. Tube A is then ready for use. Tube B is treated with *N* HCl at the rate of 1 ml/min, 100 ml distilled water at the rate of 20 ml/min, 100 ml *N* NaOH at the rate of 1 ml/min, and is then rinsed with about 100 ml distilled water at the rate of 3 ml/min until pH of the filtrate has become neutral. Tube B is then ready for use.

Procedure. The material to be tested (5 g) is weighed out, cut up fine (with scissors if necessary), and ground with a small amount of 0.1*N* HCl (1–2 ml). The ground tissue is transferred with 30 ml water into a 50-ml centrifugal tube and heated in a boiling water bath for 30 min. The solution is cooled, brought to pH 2 with concentrated hydrochloric acid, centrifuged for 10 min, and the residue washed with 10 ml 0.1*N* HCl and centrifuged. The combined centrifugates are brought to pH 5 and centrifuged for 10 min without agitation after standing for 5–10 minutes. Volume of the supernatant solution is measured and is used as an extract solution.

Six ml of the extract solution is placed in a 20-ml beaker, and 4 ml distilled water is added (sample for determination). Six ml of the same extract solution is placed in another 20-ml beaker, and 4 ml nicotinamide solution (5γ/ml) is added (sample of intermediate standard). These two sample solutions are each allowed to pass through tube A at the rate of 1 ml/min and washed with 20 ml hot distilled water at the same flow rate at 80°–85° C, using the jacket. Each combined filtrate (30 ml) is cooled to room temperature, adjusted to pH 5, then allowed to pass through tube B at the rate of 1 ml/min, and rinsed with 40 ml distilled water at the same flow rate. Each combined filtrate (70 ml) is used for the next procedure.

Forty ml of each filtrate is placed in two centrifugal tubes, to which is added 6 ml freshly prepared 25% metaphosphoric acid, and centrifuged after standing for 5–10 min at room temperature. The clear solutions are brought to pH 9.4–9.6 (thymol blue as external indicator) and heated in beakers in a boiling water bath for 30 min. The solutions are cooled, adjusted to pH 7, and the volume made up to 100 ml with KH_2PO_4-NaOH buffer solution (pH 7). They are then ready for the next stage.

One ml of each solution is placed in nonfluorescent test tubes, and 2 ml of KH_2PO_4-NaOH buffer solution (pH 7) and 1 ml of freshly prepared CNBr solutions are added to each tube. Blank solution is prepared in the same manner except that 1 ml distilled water is used in place of 1 ml CNBr solution. These three samples are heated in a water bath at 70°–80° C for 8 min, cooled in ice-cold water, and 1 ml 15% NaOH solution is added to each. After standing for 30 min at room temperature in the dark, fluorescences are measured, comparing with the blank by the use of a fluorometer or by titration, using standard fluorescent solution prepared from standard nicotinamide solutions (5γ/ml). Standard fluorescent solution is prepared as follows: 5 ml standard nicotinamide solution

(5γ/ml) is added with 10 ml KH_2PO_4-NaOH buffer solution (pH 7) and 5 ml CNBr solution, and heated in a water bath at 70°–80° C for 8 min, cooled in ice-cold water, and 5 ml 15% NaOH solution added.

Calculation. Let a = content of nicotinamide in the sample for determination; b = content of nicotinamide in the sample of intermediate standard; c = amount of nicotinamide added to the sample for determination; f = dilution factor; and r = recovery (%) of the added nicotinamide throughout the operation. Then

$$\text{Nicotinamide } (\gamma/g) = \frac{acf}{b-a}$$

$$\text{Recovery } (\%) = \frac{b-a}{c} \times 100.$$

KH-4B is a carboxylic-type cation exchange resin prepared from phenoxyacetic acid and formaldehyde, and has a total capacity of 5.84 mEq/g dry resin. The same types of cation exchange resins, Amberlite IRC-50 (Rohm & Haas Co.) (*4*) and Wofatit C (I. G. Farbenindustrie Akt.-Ges.) (*5*) may be suitable for use in place of KH-4B. Amberlite IRA-400 is a strong-base–type anion exchange resin, and has a total capacity of 2.5 mEq/g dry resin. Since the chemical characteristics of Amberlite IRA-400 are analogous to those of sodium hydroxide, carbonate-free reagents and distilled water must be used for the treatment.

Cationic impurities in an extract solution are adsorbed by the filtration through KH-4B-Na (sodium salt–type of KH-4B) at pH 5, but nicotinamide is not adsorbed by such an operation followed by the rinse with hot distilled water. Anionic impurities in an extract solution are adsorbed by filtration through Amberlite IRA-400-OH (hydroxide-type of Amberlite IRA-400) at pH 5, but nicotinamide is not adsorbed by such an operation followed by the rinse with distilled water.

Nicotinamide contents of the pupae and eggs of various types of silkworm *B. mori* were determined by the method described above, and the analytical results shown in Table 1 were obtained.

TABLE 1

NICOTINAMIDE CONTENT OF SILKWORM

Material	Nicotinamide content (γ/g)	Material	Nicotinamide content (γ/g)
Pupa of White-1 type	59	Egg of White-1 type	111
" " White-2 "	13	" " White-2 "	30
" " normal "	60	" " normal "	113

By Chaudhuri-Kedicek's method, kynurenine in the White-1 type mutant (*6*) and 3-hydroxy kynurenine in the White-2 type mutant (*6*) gave green and yellowish-green fluorescence, respectively, and unknown substances other than nicotinamide in each type of *B. mori* gave yellowish fluorescence after treatment with cyanogen bromide. Therefore the fluorescence of nicotinamide was greatly contaminated and the estimation was almost impossible. But in our method these contaminating fluorescences were eliminated completely by the use of KH-4B-Na and Amberlite IRA-400-OH, and the estimation of nicotinamide was performed without difficulty.

The new determination method of nicotinamide by use of synthetic ion exchange resins as described should be especially useful in the investigation of tryptophan metabolism in future.

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The Use of K^{42}-tagged Erythrocytes in Blood Volume Determinations[1]

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Erythrocytes have been tagged with $Fe^{55, 59}$ (*1*), P^{32} (*2, 3*), and Cr^{51} (*4*) and used for blood volume determinations by the *in vivo* dilution technique. Radiopotassium (K^{42}) has two properties that make it useful for tagging erythrocytes for special types of experiments. First, it decays by emission of energetic β-particles (3.6 and 2.0 mev) and γ-rays, which are easily detectable in liquid samples. Therefore extremely small amounts (less than 2 μc) may be used effectively. A second advantage is that it has a short physical half-life of 12.44 hr. Consequently, blood volume determinations or other studies may be repeated at relatively short intervals without concern for residual activity or hazards created by the concentration of radioisotopes in any part of the body. Furthermore, isotopes such as P^{32} and I^{131}, with appreciably longer half-lives, may be administered shortly thereafter. Because of the great difference in half-lives, the activity of the longer-lived isotope in body fluids can be determined after the K^{42} has decayed, without the need for complicated corrections.

This paper describes experiments in which comparison studies were made between almost simultaneous blood volume determinations with erythrocytes labeled with K^{42} and P^{32}. The *in vivo* half-life of the circu-

[1] Reviewed in the Veterans Administration and published with the approval of the chief medical director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or the policy of the Veterans Administration.

[2] The authors are greatly indebted to K. Newerly, biochemist of the radioisotope laboratory, for her cooperation and technical assistance in this experiment. Grateful acknowledgment is also extended to Bernard Roswit, director of the Radioisotope Unit, for making this work possible.

lating K^{42}-labeled cells was also determined. The K^{42} and P^{32} (14.3-day half-life) were obtained from Oak Ridge. Each isotope was prepared for human injection in neutral sterile isotonic saline solution.

Ten ml of heparinized blood was incubated with about 50 μc carrier-free P^{32}, and a similar volume was incubated with 100–200 μc K^{42} contained in about 50 mg of stable potassium carrier. With this carrier level, the presence of serum potassium had no effect on the uptake of potassium by the cells. The method of incubation and preparation of the blood for injection was a modification of the method described by Reeve and Veall (*5*).

The percentage of K^{42} taken up by the red blood cells ranged from 2% to 6% under varying conditions in which approximately the same amount of carrier potassium was used. The factors determining the rate of uptake are at present under study.

A weighed volume of the saline-suspended K^{42}-labeled cells was injected, and heparinized blood samples were withdrawn about 5 and 15 min later. This procedure was then repeated with the P^{32}-labeled cells. The radioactivity of the K^{42} in the injected and withdrawn samples of blood was determined immediately. The radioactivity of the P^{32} in the injected and withdrawn samples was determined 5 days later, at which time the K^{42} in the withdrawn blood was no longer detectable. The blood volume in each case was calculated in the usual manner. For the determinations of the biological half-life of the K^{42}-labeled cells, multiple specimens were taken for a 12- to 15-hr period.

The results of the almost simultaneous blood volume studies are given in Table 1. These two determinations

TABLE 1

Blood volumes

Patient	K^{42} (ml)	P^{32} (ml)	Av (ml)	Difference from av (%)
F. S.	5,940	6,400	6,170	3.7
J. R.	7,655	7,800	7,727	0.9
J. P.	4,945	4,820	4,882	1.3
O. H.	4,170	4,080	4,125	1.1
R. F.	4,750	4,870	4,810	1.3
J. B.	5,950	5,300	5,625	5.7

give essentially the same values within the errors inherent in the methods.

The biological half-life of the K^{42}-labeled cells *in vivo* ranged from 28 to 35 hr. This is consistent with studies on the *in vitro* rate of potassium uptake in red blood cells (*6*) and with studies that we will report elsewhere on the *in vivo* uptake of K^{42} by the RBC after plasma specific activity has reached a constant.

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The Metabolism of *Blastomyces dermatitidis*, Antagonists to the Growth-inhibiting Effect of Trimeton Maleate[1]

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Previous reports from this laboratory (*1, 2*) presented evidence that trimeton maleate[2] (1-phenyl-1-α-pyridyl-3-dimethylaminopropane maleate, Schering) could completely inhibit the growth of *Blastomyces dermatitidis*[3] and to a lesser extent the growth of other fungi, which results are similar to those reported by Carson and Campbell (*3*) using different antihistaminics. In our series (*2*) partial inhibition of *B. dermatitidis* was evident with 0.0003 *M* trimeton maleate, with complete suppression of growth of the fungus at 0.015 *M* concentration.

For investigation of the therapeutic implications of these findings, mice were infected with *B. dermatitidis* and treated with trimeton maleate. Twenty-eight albino mice of the Swiss strain (18–20 g) were infected by the intraperitoneal route with a heavy suspension of the yeast phase of *B. dermatitidis* suspended in 4% maltose, 1% peptone water. The organisms used for the mouse inoculations had been grown on blood agar in the incubator at 37° C for 2 weeks. The animals were divided into 2 groups for therapy, with paired controls receiving no treatment. Therapy was administered by subcutaneous injection of trimeton maleate, with a daily dosage of 40 mg/kg, divided into 2 injections/day. One group of the treated mice received therapy from the day of infection; in the other group therapy was initiated on the tenth day after the date of infection. For the prophylactic trial, 20 mice were divided into 2 groups. One group received 40 mg/kg trimeton maleate daily for 5 days preceding infection with *B. dermatitidis*; the other group received no pretreatment, and treatment was instituted at the time of experimental infection.

All animals were sacrificed on the twenty-first day after infection, since in the experience of Spring (*4*), infection with *B. dermatitidis* is at a maximum in mice at this time. At autopsy, infection could be readily demonstrated by the presence of widespread nodules and partly necrotic masses affecting the mesentery, the retrosplenic and retrohepatic regions. Infection was determined by positive wet mounts, positive cultures, and by demonstrating the microorganism in histological sections.

These experiments indicated that trimeton maleate,

[1] Preliminary report.

[2] For generous supplies of trimeton maleate, we wish to express our gratitude to Edward Henderson, director of clinical research, Schering Corp., Bloomfield, N. J.

[3] We are indebted to Harry Seneca for his kindness in supplying the strain of *Blastomyces dermatitidis* used in this study.

TABLE 1

COMPARISON OF EXTENT OF GROWTH OF *Blastomyces dermatitidis* ON TRIMETON MALEATE TREATED MEDIUM* IN THE PRESENCE OF ADDED NEOPEPTONE AND ASHED NEOPEPTONE

Addition of neopeptone			Addition of ashed neopeptone		
Amt neopeptone added (mg)	Colony diam (mm) Tube 1	Colony diam (mm) Tube 2	Amt ashed neopeptone added† (mg)	Colony diam (mm) Tube 1	Colony diam (mm) Tube 2
200	6	7	7.8	6	7
400	17	12	15.6	11	10
600	17	19	23.4	19	20

Control Cultures Run Simultaneously‡

Additions	Observations
No addition	Good growth covering entire slant
0.03 *M* trimeton maleate (final concentration)	No growth
400 mg neopeptone	Enhanced growth covering entire slant
15.6 mg ashed neopeptone	Enhanced growth covering entire slant

* Medium: 4% glucose, 1% neopeptone agar, with a final concentration of 0.03 *M* trimeton maleate. Standard amount of medium used was 20 ml/tube.

† 7.8 mg ashed neopeptone is equivalent to 200 mg neopeptone.

‡ Medium: 4% glucose, 1% neopeptone agar used; amount, 20 ml.

under the conditions of the experiment, failed to prevent the infection, and furthermore the infected animals did not respond favorably to the therapy with trimeton maleate.

In order to elucidate the mechanism of the *in vitro* inhibitory effect of trimeton maleate on the growth of *B. dermatitidis*, a series of experiments was conducted to determine a means of reversing this inhibition and to search for an explanation of the mechanism. For that purpose the following substances were incorporated in an 0.03 *M* trimeton maleate, 4% glucose, 1% neopeptone agar: (1) neopeptone (Difco); (2) ashed mineral residue of neopeptone (Difco); (3) histamine dihydrochloride; (4) l-histidine monohydrochloride (Tables 1 and 2). Before incorporation of the added substances, the pH in each instance was adjusted to the pH level of the medium. Experimental tubes were inoculated at one point from a fresh culture of *B. dermatitidis* and incubated at room temperature for one month, when the extent of growth was determined by inspection.

Reversal of the inhibitory effect by additions of neopeptone (200–600 mg neopeptone added per 20 ml culture medium) induced us to investigate whether the mineral content or the organic part of the neopeptone was involved in this mechanism. After adding ashed neopeptone (ashed residue of 200–600 mg neopeptone per 20 ml culture medium) to the trimeton-containing glucose medium, growth of *B. dermatitidis* was obtained that was equal in each case to the growth with the corresponding amount of neopeptone. Thus the ashed residue evidently caused a marked reversal of the inhibitory effect of trimeton maleate. Growth with the largest amount of ashed residue added (equivalent of 600 mg neopeptone) was not quite equal to the growth in the untreated control, but the extent of growth in the experimental tubes varied directly with the concentration of added ashed residue (Table 1).

Subsequent trials with the following cations were and are being performed: Mg, Na, K, Ca, Li, Ba, Ni, Sr, and Fe. With the exception of nickel and lithium, the remaining metals (added in molar concentrations equal to the concentration of trimeton maleate in the medium as well as in twice that amount) showed appreciable reversal of the growth inhibition by trimeton maleate. The effect of the addition of several anions on the suppression of growth of *B. dermatitidis* by trimeton maleate is being studied.

Although actually we have no proof to offer that the cations tested are part of an enzyme system of *B. dermatitidis*, in the light of our experiments such a possibility can be considered. Similar investigations were conducted by Abelson and Aldous (*5*), who demonstrated that the toxicity of Ni, Co, Cd, Zn, and Mn for *Escherichia coli* could be lowered by adding large amounts of magnesium. In a similar way the toxicity of Ni and Co could be diminished in the presence of magnesium in the case of three other organisms tested: *Aerobacter aerogenes, Torulopsis utilis,* and *Aspergillus niger*. It is of additional interest to mention that Utter and Werkman (*6*) have demonstrated that Mg activated an important enzyme converting phosphoglycerate to phosphopyruvate. This enzyme acts partially without the addition of the divalent metal. The addition of small amounts of Ni

TABLE 2

ADDITIONS OF HISTAMINE AND HISTIDINE TO TRIMETON MALEATE TREATED MEDIUM, INOCULATED WITH *Blastomyces dermatitidis*

Tube No.	Molar concentration of trimeton maleate	Molar concentration of histamine	Molar concentration of histidine	Observations
1	0	0	0	Good growth*
2	0.03	0	0	No growth
3	0.03	0.03	0	" "
4	0.03	0.06	0	" "
5	0.03	0.09	0	" "
6	0	0.06	0	Enhanced growth
7	0	0.09	0	" "
8	0.03	0	0.03	No growth
9	0.03	0	0.06	" "
10	0.03	0	0.09	" "
11	0	0	0.06	Enhanced growth
12	0	0	0.09	" "

* Results reported represent 6 replicate tubes for each condition with uniform findings.

to the medium, however actually reduces the activity of the enzyme and at a higher concentration stops it completely. It thus appears possible that the cations Mg, Na, K, Ca, Ba, Sr, and Fe play a certain role in the enzyme systems of *B. dermatitidis* which may be bound by the addition of trimeton maleate and can be overcome by a certain concentration of the abovementioned cations.

From a pharmacological point of view it was deemed of interest to determine whether added histamine and/or histidine could neutralize the growth inhibition by trimeton maleate in a way similar to the neutralization of the histamine effect by this agent in human and animal experiments. Histamine and histidine, singly and combined, were added to trimeton-treated culture medium in amounts ranging from one half to three times the molar equivalent of the combined trimeton. Results of the trials revealed that addition of histamine and/or histidine failed to overcome the growth inhibition of *B. dermatitidis* by trimeton maleate under the conditions of the experiments.

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Visual Acuity and the Normal Tremor of the Eyes[1]

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Recent measurements have demonstrated that the "grain," or mosaic structure, of the retina does not set a limit to the resolution of fine detail. For example, it has been shown that a dark line is visible against a bright field if its width subtends a minimum angle of 0.5″ at the eye of the observer (*1, 2*). Vernier displacements of slightly under 2″ are now reliably reported (*3, 4*). Stereoscopic and real depth thresholds of about 2″ have consistently been obtained (*4–9*). Since the subtense of a single cone receptor is not less than 15″–30″ at the center of the human fovea (*10, 11*), it appears that human visual resolution is 10–20 times better than one might anticipate on the basis of "local signs" from individual receptor cells.

The various hypotheses that have been suggested to account for resolution share the central idea that discreteness in the spatial arrangement of the receptor cells is somehow compensated for by continuity in time. That is, the relatively large receptor cells may "scan" the image and convey to the brain a temporal and spatial pattern of nerve impulses which signal the presence and relative position of the corresponding objects in space. In short, the most sensitive local signs from the retina are "mean local signs" (*6*) and not "cone receptor local signs." A mean local sign is derived from a temporal summation of graded responses of a number of receptor cells, so that its spatial position is not restricted to the discrete position of any one cone receptor.

It is not our purpose to summarize or evaluate here the "dynamic" theories of visual acuity. The reviews by Walls (*9*) and Senders (*12*) may be consulted in this connection. Rather, we wish to describe some experiments that appear to demonstrate the role of mean local signs in binocular vision. Our conclusion from these experiments is that the "corresponding points" of binocular vision represent corresponding mean locations on the retina, rather than a one-to-one correspondence between cone receptors in the two eyes.

The basic system of recording eye movements by the use of a contact lens has been described elsewhere (*13*). The diagram in Fig. 1 shows the manner in which this system has been modified for binocular measurements. Plane, first-surface mirrors at M_1 and

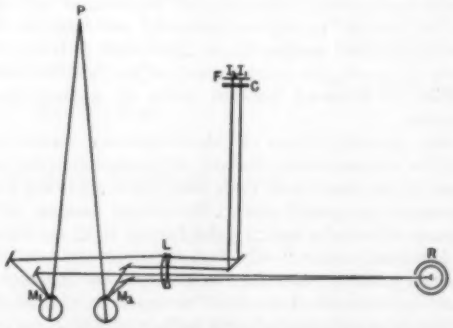

FIG. 1. Diagram of apparatus for recording the horizontal component of binocular eye movements (not drawn to scale).

M_2 are mounted on plastic contact lenses that have been fitted to the eyes of the subject. Any rotation of the eyes in the horizontal plane will displace the images at I_1 and I_2, formed by lens L of a vertical ribbon filament R. A cylindrical lens C serves to concentrate the vertical line images as points on the recording film F. The film, moving at a constant speed, registers the horizontal component of the movements of each eye during attempted steady fixation on a point P.

Binocular records have been obtained for two of the five subjects who took part in the original investigations (*13*). Fig. 2 contains samples of records from one subject. The relatively large involuntary drifts and jerky motions, described in earlier investigations (*13–15*) are in general rather closely synchronized. They appear to be coordinated in the achievement of convergence and lateral fixation on the target point. Note, however, that the relatively small involuntary tremor movements are independent for the two eyes.

[1] These experiments were done under Contract N7onr-358, Task Order II, Project NR-140-359, between Brown University and the Office of Naval Research.

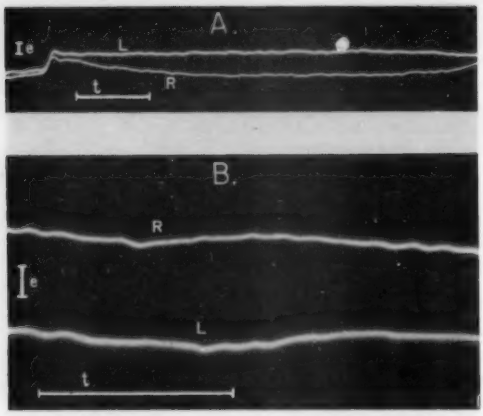

FIG. 2. Sample records of eye movements for one subject. *A*, records showing sudden jerky movement, slow drifts, and minute tremor; *B*, enlarged view of the tremor movements. In each record *L* is the trace for the left eye and *R* for the right eye, *t* represents $^2/_{10}$ sec of time, and *e* represents 100 sec of angular rotation of the eye.

These movements, occurring at frequencies up to 90/sec, amount to approximately 15 sec rotation of the eye in their median extent from crest to trough.[2] They are perhaps a natural result of the fact that the eyeball is balanced between pairs of antagonistic muscles.

Our conclusion from the above-described results is that the eyes are never similarly stimulated by a single point in the visual field. Over brief intervals, when no movement is present except for minute tremor, the mean position of a retinal point for the right eye may be identified rather closely with the mean position of a corresponding point for the left eye. The instantaneous separations of the two "corresponding" retinal points, however, must deviate rather widely (i.e., to a median extent of 10–20 sec of arc) from the mean separation. It therefore appears that the notion of anatomical corresponding points on the retina must be modified to include a rather broad range of correspondence.

The above conclusion is seemingly at variance with the data on stereoscopic acuity which reveal that disparities of about 2 sec of arc between the images for the two eyes can be used as cues for the perception of depth. In other words, the correspondence of image points for the two eyes is much closer than the correspondence of points on the retina. We may perhaps resolve this apparent contradiction by assuming that in stereoscopic vision we somehow integrate in time so that the mean retinal location rather than instantaneous retinal location is the basis for stereoscopic acuity. Existing data on the subject of exposure time (*7*) do reveal very much lower acuity for brief flashes than for longer exposures, as would be expected from the above hypothesis.

Finally, it appears that we must qualify the traditional concept of "corresponding points" in binocular vision. We must go beyond the assumption of an exact pairing of cone receptors in the two eyes. Although it may exist, such pairing is not in itself sufficient as a mechanism for the detection of such minute displacements of the image as are perceived stereoscopically. We do not wish to speculate further at this time, except to point out that both spatial and temporal patterns of impulses from the two eyes must somehow be combined centrally. The discreteness of retinal elements is therefore shown to be no more significant in relation to stereoscopic acuity than to the resolution of vernier displacements of fine black lines.

[2] This particular subject has the steadiest eyes of five subjects used in an earlier investigation (*13*). Hence the figure of 15 sec may be taken as a conservative estimate of the extent of such tremor. The measurements of the angle θ of rotation of the eye were obtained by use of the relation $\tan \theta = \frac{d}{2f}$, where d is the deflection of the photographic trace and f is the (focal) length of the optical path from the lens *L* to the film *F* in Fig. 1.

Control experiments, some of which were reported in the earlier paper (*13*), reveal that contact lenses which are individually fitted to the eyes adhere tightly and follow the tremor without appreciable slippage.

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Comments and Communications

Geology in the Grade Schools

Most large universities have courses in geology, but they reach only a small segment of the population. An early foundation in geology is desirable for the many who never get to college. Why not start in the grade schools? Childhood is the age of wonder, of fresh impressions, of deep curiosity, and of great imagination—just the period of life in which geology should most appeal to young minds and can be best presented.

Children are eager to know the why of things, and simple, intelligent explanations of the objects around them would furnish a sound basis for understanding natural phenomena. Teach geology as the Mother of Sciences, not as one of the natural sciences. Some religious groups still think that the universe was formed in 4004 B. C. and consider that geology upsets the Bible. Such groups are politically powerful in many places and will, no doubt, oppose the introduction of geology in the grade schools. Their main objections are the fear, first, of upsetting Bishop Upshur's Age of Creation, 4004 B. C., and, second, of giving support to the theory of the evolution of man from lower animal forms. Geologic processes cannot be well taught without the time element, but evolution need not be presented in the grade schools.

It is outrageous that geologic subjects are so much neglected in the grade schools. In physical geography one finds references to metals and minerals and to nonmetallics, but there is insufficient information to supply the pupils with a sound idea of what goes on around them.

A dust storm furnishes a fine example of wind action; a heavy rainstorm, a lesson in erosion. Plaster and stone all come from rocks. The streets are made of concrete; in fact, the construction materials all contain a geologic story. Samples of sand, limestone, sandstone, and other rocks should be shown. It is really pitiable to find grown men and women who cannot recognize even the simplest rocks.

The fuels—natural gas, oil, and coal—can be explained in geologic terms. Agates and marbles and synthetic products should fall into the study, as well as gems and precious metals. Copper, brass, tin, and lead vessels are used daily in every home, as are china and pottery. Trace these products to their origins, and correlate the information by showing samples of ore and other raw materials.

Fossils introduce the subject of ancient life. The knowledge that living forms had ancestors millions of years old will appeal to children. Children should learn early that the sun is a great star, one of many billions, and the earth is perhaps but one of many billions of planets, with all the elements found in the sun.

Groundwork carried through the grade schools would in time give every child a knowledge of geology. In high school some laboratory work could be done on rocks and minerals. Earth processes, and even historical geology, could be discussed in greater detail. Students who do not go to college would at least have a solid foundation in general geology, and a better appreciation of the earth than most college students now possess.

The introduction of geology into the grade schools will demand tact and patience, and require organized educational processes. Simple school texts must be carefully and sympathetically written and skillfully illustrated. The books should be prepared by able geologists, even if they use "ghost" writers to assist them, since many scientific men deplore simplification or scorn it as unscientific. Geologists with the ability of a McGuffey should write such books. In a generation they would do more to make people realize that geology is a vital science than all the college texts and treatises.

All geologists should work together for the teaching of the most fundamental of sciences in grade schools. In time their efforts would result in more open-minded acceptance of the idea from educators and the public.

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Physiologic Limits of Vision

In their paper entitled "The Physiologic Limits of Vision in Physiographic Observation" (*Science*, 113, 176 [1951]), Olmsted and Olmsted stated that ". . . a cliff 100 ft high, at a distance of 13.06 miles, will subtend an angle of 5′, as does the letter of the Snellen '20-20' line viewed at its standard distance of 20 ft. It will be just perceived as a discontinuity of form by a person with 'normal' vision." The conclusion is then reached that, ". . . the discussion leads to a simple rule for field observation: a 100-ft cliff at 13 miles will be just perceptible under optimum conditions." The calculations seem to be based upon two erroneous concepts of visual acuity:

1. "Just perceptible" is dependent upon the size of detail (1′) rather than the over-all size of the letter (5′). Thus, if the comparison to the Snellen chart were to be made, it is a 20-ft cliff and not a 100-ft cliff that could be just perceived at the 13-mile distance.

2. The situation described is, however, not analogous to the perception of Snellen letters but rather to the recognition of vernier offset or change of contour, a faculty referred to by Duke-Elder (*Textbook of Ophthalmology*. St. Louis: Mosby, Vol. 1, 934 [1940]) as the faculty of the discrimination of contours. The average monocular threshold for this faculty is approximately 10″, and hence a cliff only 3.3 ft in height could be perceived at the distance of 13

miles. Binocular thresholds as low as 2″ were found by one of the undersigned (Anderson and Weymouth, *Am. J. Physiol.*, **64**, 561 [1923]) for vernier acuity, which would mean that under optimum conditions a "cliff" less than 1 ft in height could be recognized as a change in contour at a distance of 13 miles.

The conditions of contrast, illumination, absence of haze, and others mentioned by Olmsted and Olmsted would, of course, have to be optimum to obtain thresholds like those mentioned. In addition, since it is vernier acuity that is being considered, each line (ground and cliff level) would have to be of sufficient length.

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OUR paper was not primarily concerned with an exact definition of the resolution limits of the human eye under conditions of laboratory technique. Rather, we are attempting to evaluate the observations it will make in the field as an "instrument" of the reasonably careful observer of terrain.

It is true that the precision of laboratory instruments such as range finders, vernier scales, and the like is attained through observations of linear discontinuity far more subtle than 1′ of arc. Here the field is well illuminated, contrast is enhanced, and, above all, attention is meticulously directed to a single predefined region, line, or point. Under these conditions distinctions of the order of 2″–10″ are observed because the image on the mosaic of cones overlaps.

Again, it is true, as we pointed out below Table 1 of our paper, that the average normal eye will distinguish as unique a visual image subtending 1′ of arc. Indeed, many eyes will better this resolution somewhat. Here, again, good black-and-white contrast and adequate illumination are implied. The Snellen E is made up of three bars, subtending (for the 20/20 line) 1′ each and spaced 1′ apart. This 5′ form is easily observed at 20 ft by a normal eye as a recognizable letter when printed to extreme contrast and well illuminated.

We concluded, then, that under field contrast, haze, thermal distortion, and illumination, a cliff subtending about this angle would be recognizable by a careful observer scanning the horizon for detail. The chart of Fig. 1 was carefully drawn to illustrate this when viewed at 20 ft, to allow the interested reader to form his own "standard" based on this concept. In the construction of the chart other discontinuities of the order of 1′ of arc were purposely included. The knoll to right of center rises above the adjacent background by 1′. The notch half an inch to the left of it is of like dimension but with lower contrast of shading. The former is marginally distinguishable when sought as a known point, but the latter cannot be found. We agree, therefore, that meticulous attention to a minute sector of the horizon might permit the definition of these subtle discontinuities. However, such microscopic examination is not the method of even the most objective observer of topography in the field.

Hirsch and Weymouth have transferred our original subject matter from the field of geomorphology to that of a fine point of physiological optics. They quote our warning about haze, contrast, and illumination and admit that they would have to be "optimum" to reach their stated limits. They would not be satisfied by attainable optima. Rather they would have to be supernatural for 67,000 ft of atmosphere. Simple geometric extrapolations of the type being made by Hirsch and Weymouth are only valid in a vacuum. Thermal currents and minimum dust and haze completely vitiate them in the earth's atmosphere.

You can perhaps obtain from your window a line of sight to a building 1 mile away. Normal architectural cornice work allows discontinuities of the order of 1 in. If you could perceive these on a building 1 mile away, you would begin to approach Weymouth's 1 ft at 13 miles.

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A Choice of Difficulties

IN A recent letter G. W. Leeper (*Science*, **113**, 213 [1951]) states that scientific journals should either suppress bad work or else publish criticism of it. While agreeing with his main contention, I think attention should be called to a third course that is unfortunately followed by many editors. This is the publication of a paper after the removal of its worst features. In this form it may look like a contribution to knowledge and may mislead any reader who does not know the author personally.

If a paper has not been heavily edited, it is often possible to assess the competence of the author from the manner in which he writes or from internal inconsistencies in the paper. But when the style has become that of the editor, and when referees have ironed out the inconsistencies, what is the reader to do? Undoubtedly many papers are only sent to the editor after they have been improved in this way as a result of criticism by colleagues in the laboratory. This criticism, however, generally leads to some experimental revision; editing is a purely literary matter.

I contend that, if any paper has been subjected to significant editorial improvement—that is, to more than is needed to bring it into line with the conventions of the journal—this fact should be noted. An indication of the actual extent of the editing would be even more valuable.

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Book Reviews

Natural and Synthetic High Polymers. 2nd ed. Kurt H. Meyer. New York–London: Interscience, 1950. 915 pp. $15.00.

This new "completely revised and augmented edition," like the first edition, has as its objective the presentation of a systematic account of the entire field of natural and synthetic inorganic and organic high polymers. The first edition established itself as a textbook giving an inspiring and broad introduction to the theoretical aspects of high polymer chemistry. It has been found a valuable correlative reference work, offering key references and a stimulating and broadened viewpoint for the research worker. The second edition will be even more valuable in both applications.

The text has been increased approximately 28% to encompass new trends appearing in the literature. Conservative expansions have been made in many areas, and considerable portions have been rewritten. An indication of how thoroughly the book has been revised can be obtained by comparing the references cited. The new edition contains nearly 2,100 entries, many of which include more than one literature citation. Not only have many new references been added, but some of those appearing in the first edition have been deleted. The entries indicate that the literature survey was completed through 1949. The largest expansion (from 43 to 137 pp.) of any major subject area was made in the section on "Properties of High Polymers in Solution," written in collaboration with A. J. A. van der Wyk. In fact, this section became two, the second being "Elasticity, Viscosity and Plasticity of High Polymers," on which C. Weissenberg also collaborated. In view of the considerable progress and publication in the field of synthetic rubbers in the past decade, it is surprising, even disappointing, that the discussion of these polymers has decreased slightly. The book is remarkably free of errors, and congratulations on this point are due to author, translator, and publisher.

Expansion of the subject index (from 11 to 28 pp.) has not been entirely due to the introduction of new material, but to a new format and an effort to render the work more useful as a reference. Despite the excellent cross index, the specialist will miss many interesting references to his own field unless he reads the entire volume in detail. For example, the index will not reveal to the elastomer worker comments on the rubberlike properties of melted cheese (p. 573), the contrast of muscular contraction and relaxation with unvulcanized and vulcanized rubber (p. 571), properties of pure amorphous rubber (p. 527), pictures of stretched and frozen rubber compared with tendons (p. 533), several comparisons between rubber and proteins, etc. Or, if an investigator seeks references to uronic acids (galacturonic, glucuronic acid), or aldobionic acid (pp. 440–441), chitosan (p. 452), glutathione and asparthione (p. 619), or the use of the sodium salt of starch-glycolic acid as an emulsifying agent (p. 482), etc., he may fail to spot these because of their absence from the index. These comments are meant not as criticisms of an excellent index but rather as indications of the intriguing and provocative correlations of polymeric chemistry that the author makes.

The specialist will find the book helpful in broadening his concepts, but he will also be due for certain disappointments. He will probably feel that his own field has been inadequately discussed. In spite of the careful literature annotations, he will find interesting comments for which references are lacking; for example, "Sulfonated polyanethole (Liquid Roche) is said to have an effect like that of heparin in preventing clotting of the blood" (p. 181), and "other olefins such as nitroethylene can also be polymerized" (p. 182). American readers probably will note the absence of some familiar developments, trade names, and references and more utilization of European data less familiar to them.

The student will enjoy the systematic arrangement of the subject matter, analogous to the order of presentation in the chemistry classroom. The chemistry of inorganic high polymers is presented first, followed by the chemistry of organic polymers arranged in the order hydrocarbons, halides, alcohols, ethers, esters, sulfides, cellulose, polysaccharides, lignin, proteins, then the physical properties of high polymers, and finally the biochemistry of high polymers. The student will find here a brief but adequate picture of the fields of high polymer chemistry, but with a minimum of comment on industrial applications. In employing this volume as a textbook, the proximity of the author to German and other European viewpoints and literature should be borne in mind. For example, those who have had a part in the U. S. synthetic rubber program would not unanimously agree with the implications of its initial complete dependence on German "know-how" set forth on page 214:

> As a result of an understanding which provided for a complete exchange of patents and experience reached with I. G. Farbenindustrie in 1929, the Standard Oil Company of New Jersey had the process at its disposal and during the war issued licenses to numerous other works supported by the U. S. Government. Investigations were carried out to improve the process and to adapt it to large-scale manufacturing, so that today an enormous quantity of these synthetic rubbers is produced in the United States; moreover the research work carried out under the sponsorship of the Rubber Reserve has led to products highly superior in quality to the original German Buna S.

That the "know-how" was *not* available is indicated by the following statement by Thurman Arnold in the hearings on scientific mobilization (Hearings on Senate Bill 702, 78th Congress, 1st Session, Part I, p. 48,

March 30, 1943): "The know-how on making the synthetic rubber itself was not given to anyone outside Germany because the Hitler Government prohibited it." Again, the neophyte may gather that butadiene is predominantly synthesized from acetylene, a process not employed in this country (p. 215). In connection with sodium polymerizations, it would seem that a reference to the excellent work of A. A. Morton *et al.* with alfin catalysts was deserved. In the recipe for GRS given on page 218 appears the notation "fatty acid soap (90% sol)," which needs interpretation.

On pages 218 and 219 Buna S_3 is twice mentioned, and it is stated, "No copolymer proved better than Buna S_3," yet no explanation is given regarding what Buna S_3 is polymerically. On page 223, in discussing the properties of Butyl rubber, no mention is made of its outstanding low gas permeability, the property that has brought it into wide use in inner tubes.

That this book is far more than a reference work or a textbook, but has as its objective the setting forth of a concept with all the eloquence of a superb teacher, investigator, and writer, is indicated by the following closing sentences:

> The number of problems in the solution of which biology and the chemistry of high polymers must join forces is infinite; wherever there is life there is structure, a structure built up from high polymeric molecules. As research advances, the greater is our perplexity, the greater our veneration and admiration for the true master of our science—living Nature.

This book should be read by all who are interested in high polymers.

HAROLD P. BROWN

B. F. Goodrich Research Center
Brecksville, Ohio

The Principles of Cloud-Chamber Technique. J. G. Wilson. New York: Cambridge Univ. Press, 1951. 131 pp. $2.75.

With the recent increase in the use of cloud chambers for experiments on high-energy particles, especially in connection with the large accelerators, there has been a great need for a book describing the techniques used in cloud chamber work. It is a pleasure to report that this book, though quite short, goes a long way toward filling this need. Wilson has spent many years working with cloud chambers and has had the advantage of working in the laboratories of C. T. R. Wilson, inventor of the cloud chamber, and P. M. S. Blackett, who made many important contributions in the development of cloud chambers into precision instruments.

The book begins with sections on the fundamental theory of cloud chambers and the ionization of high-energy particles, continues with chapters on operation and photography, counter control, and techniques of precision measurements. The final chapter on the interpretation of cloud chamber photographs is a subject that deserves somewhat more space than it was given. Although much of the material has been published elsewhere, it is scattered through various periodicals and often difficult to find. Dr. Wilson has collected and correlated the work of many experimenters and has in addition added a considerable amount of heretofore unpublished information, especially in the sections on photography and on measurement techniques. The actual mechanical design of cloud chambers is almost completely omitted, but many operational techniques are included that are never mentioned in the literature. The discussion of continuously sensitive cloud chambers is limited to a description of Langsdorf's chamber and does not include some of the recent work on these instruments.

The writing is clear and concise, and the book is likely to be very useful to anyone using or planning to use a cloud chamber.

W. B. FRETTER

Department of Physics
University of California, Berkeley

Scientific Book Register

The Sea Around Us. Rachel L. Carson. New York: Oxford Univ. Press, 1951. 230 pp. $3.50.

Structural Geology of North America. A. J. Eardley. New York: Harper, 1951. 624 pp. $12.50.

Lectures in Abstract Algebra: Basic Concepts, Vol. I. Nathan Jacobson. New York: Van Nostrand, 1951. 217 pp. $5.00.

The Chemistry and Action of Insecticides. Harold H. Shepard. New York–London: McGraw-Hill, 1951. 504 pp. $7.00.

Enzymes and Enzyme Systems: Their State in Nature. John T. Edsall, Ed. Cambridge, Mass.: Harvard Univ. Press, 1951. 146 pp. $2.75.

The Enzymes: Chemistry and Mechanism of Action, Vol. I, Part 2. James B. Sumner and Karl Myrbäck, Eds. New York: Academic Press, 1951. Pp. 725–1361. $12.80.

Pierre Curie. Marie Curie; Autorisierte deutsche Ausgabe von Anna Kerschagl. Vienna: Springer-Verlag, 1950. 89 pp. $1.00.

Electroencephalography in Clinical Practice. Robert S. Schwab. Philadelphia–London: Saunders, 1951. 195 pp. $6.50.

Ruwenzori Expedition 1934–5: Chloropidae, Vol. II, No. 7. Curtis W. Sabrosky. London: British Museum (Natural History), 1951. Pp. 711–828. 15 s.

Watch Out for the Weather. Jacqueline Berke and Vivian Wilson. New York: Viking, 1951. 226 pp. $2.95.

Diseases in Old Age. A clinical and pathological study of 7,941 individuals over 61 years of age. Robert T. Monroe, Cambridge, Mass.: Harvard Univ. Press, 1951. 407 pp. $5.00.

Audubon Water Bird Guide: Water, Game and Large Land Birds. Sponsored by National Audubon Society. Richard H. Pough. New York: Doubleday, 1951. 352 pp. $3.50.

Progress in Metal Physics, Vol. 2. Bruce Chalmers, Ed. New York: Interscience; London: Butterworths, 1950. 213 pp. $8.00.

Clinical Tropical Medicine. R. B. H. Gradwohl, Luis Benitez Soto, and Oscar Felsenfeld, Eds. St. Louis: Mosby, 1951. 1,647 pp. $22.50.

News and Notes

Scientists in the News

Richard T. Allman, formerly technical adviser in the Agriculture Division of FAO, is now chief of the UN International Children's Emergency Fund Mission. He will be in Chile approximately two years, directing projects that involve production of diphtheria–whooping cough vaccine, maternal and child health with special emphasis on tuberculosis, and milk conservation and nutrition.

The Senate has confirmed the Presidential nomination of **George E. Armstrong** to be surgeon general of the Army for a statutory four-year term that began June 1. General Armstrong succeeds **R. W. Bliss,** under whom he has served as deputy surgeon general for the past four years.

Walter Bauer has been appointed Jackson professor of clinical medicine at Harvard Medical School and chief of medical services at Massachusetts General Hospital. Dr. Bauer will succeed **James Howard Means,** who has held both posts since 1923. He has been associate professor of medicine at Harvard and physician at the hospital. His work has centered on the study and treatment of rheumatism and arthritis, with special attention to rheumatoid arthritis.

Otis O. Benson, Jr., commandant of the School of Aviation Medicine, presented a paper on "The Medical Problems of Flying" at the 13th International Congress of Military Medicine and Pharmacy in Paris. Accompanied by Deputy Commandant **Frederick J. Freese, Jr.,** he will also visit aeromedical research and teaching institutions in Denmark, Germany, Sweden, and the United Kingdom. Surgeon General **Harry G. Armstrong** and Deputy Surgeon General **Dan C. Ogle** also attended the Congress.

Howard Berry, formerly vice president, treasurer, and director of Mathieson Chemical Corporation, has joined R. S. Aries & Associates, New York consulting engineers and economists, as senior associate. Mr. Berry was with Mathieson 28 years.

P. A. Berry, USDA entomologist, is in El Salvador, where he will assist local scientists in the control of insects affecting that country's food and fiber crops. The assignment was made at the request of the government of El Salvador and in cooperation with the Technical Cooperation Administration, Department of State, as a part of the Point IV program of sharing technical abilities with other countries. Mr. Berry will join 6 other OFAR specialists at the jointly operated agricultural station. The U. S. and El Salvador have been collaborating for agricultural improvement since 1942.

Edwin W. Blase, project engineer in the Research and Development Department of Chas. Pfizer & Co., Inc., has been given the award of the Chemical Engineers of Greater New York. The society's certificate gives professional recognition only to chemical engineers under 32 years of age and was made to Mr. Blase as "sole inventor of the unique Q-process for the recovery of terramycin which expedited the early large-scale production of a life-saving drug." The award was made this year for the first time. Honorable mentions went to **Thomas P. Forbath,** director of research and development and supervising engineer of the Chemical Construction Corporation, and to **Frank E. Penn,** assistant to the president of the Minute Maid Corp. William Trotter, Celanese Corp., was chairman of the awards committee; other members were Joseph A. O'Connor, news editor of *Chemical Engineering*; P. D. Birkhahn, Allied Chemical & Dye; and Robert D. Burleson, Merck & Co., Inc.

Gerard A. Bourbeau, of the Soils Department of the Connecticut Agricultural Experiment Station, has been granted a year's leave of absence to serve on an expedition to the Belgian Congo for ECA. The mission, organized by the USDA, will consist of about ten American agricultural scientists, who will study the natural resources of the Belgian Congo and attempt to determine what crops can be successfully grown there. Dr. Bourbeau will make his headquarters at the Astrida Experiment Station in Ruanda-Urundi, a United Nations–administered colony, under mandate to the Belgian government. During his absence, his place at the Connecticut Agricultural Experiment Station will be filled by **Gerhardt Talvenheimo,** research fellow at Purdue.

Douglas E. Bragdon, assistant professor of anatomy at the University of Virginia, has received a grant from the NRC Committee on Research in Problems of Sex for studies on the corpora lutea of ovoviviparous snakes.

S. W. Britton, professor of physiology at the University of Virginia, has been appointed visiting professor of endocrinology at the University of Nigeria, British West Africa, and will leave for Africa in February 1952. The appointment was made by the Department of State under terms of the Fulbright Act. Dr. Britton will be on leave of absence during the second semester and will retire at the end of the year, after 24 years of service.

W. L. Burlison, one of the founders of the soybean industry, was honored by about 425 of his friends at a recognition banquet upon his retirement. Dr. Burlison will retire September 1 after 39 years of service to Illinois agriculture. He served 31 years of that time as Agronomy Department head at the University of Illinois.

The Eli Lilly and Company award for outstanding research in bacteriology and immunology has been given to **Seymour S. Cohen** by the committee on awards of the Society of American Bacteriologists. Awards

have been made by Lilly to outstanding scientists in the field of bacteriology since 1926. Recognition was given to Dr. Cohen for his studies of biochemical relationships between viruses and the cells they infect. He is assistant professor of physiological chemistry in the Department of Pediatrics, School of Medicine, University of Pennsylvania, and is also associated with the Philadelphia Children's Hospital.

William L. De Baufre will be retired September 1 from the chairmanship of the Department of Engineering Mechanics at the University of Nebraska. He will not be retained in a teaching position because the organization of the department is to be changed.

Harry F. Dowling has been appointed professor and head of the Department of Internal Medicine at the University of Illinois College of Medicine. He will succeed **Robert W. Keeton,** who retired from active service at the end of the academic year 1950–1951. Dr. Dowling has been serving as professor and head of the Department of Preventive Medicine at the University of Illinois.

Paul B. Dunbar, commissioner of food and drugs, has been succeeded by deputy commissioner **Charles W. Crawford.** Dr. Dunbar, who was selected by the late Harvey W. Wiley as one of the original group to undertake enforcement of the Pure Food and Drugs Act of 1906, has reached the retirement age. Mr. Crawford has been in government service 34 years.

J. Harlan Johnson, professor of geology at the Colorado School of Mines, is collecting and studying coralline algae in the Trust Territory and Okinawa for the island mapping program of Pacific Geologic Surveys Section, Military Geology Branch, U. S. Geological Survey. Dr. Johnson plans to be in the Pacific area this summer, and following his return to Colorado will continue systematic study of fossil algae collections and Pacific Island limestones.

H. Walter Jones and **Russell E. Duff** have joined the staff of the Los Alamos Scientific Laboratory. Both will work with Duncan P. MacDougall, division leader. Dr. Duff has been associated with the Engineering Research Institute at Ann Arbor, Mich., where he did research on the diffraction of shock waves. Before going to Los Alamos, Dr. Jones was employed as a chemist with the USDA Western Regional Research Laboratory, Albany, Calif.

Harry F. Olson, director of the Acoustical Research Laboratory of RCA Laboratories, has been elected president of the Acoustical Society of America for the year 1952. Dr. Olson has been engaged in acoustical research in the Radio Corporation of America since 1928 and has been director of the Acoustical Laboratory in Princeton since 1946.

Mata Prasad, principal of the Institute of Science, Bombay, is visiting the U. S. on a State Department grant, to spend approximately three months studying the activities of the National Bureau of Standards. Other recent visitors from abroad have been **Alan T. Pickles,** head of the Physics Division of the Building Research Station, Garston, Eng.; **Ragnar Schlyter,** Swedish Government Institute for Handicrafts, Arts and Trades, Stockholm; **J. W. Illingworth,** Dunlop Rubber Company, Fort Dunlop, Birmingham, Eng.; and **Sakae Yagi,** Department of Chemical Engineering, University of Tokyo.

Mildred C. Rebstock, a Parke, Davis & Co. research chemist who played a part in the synthesis of chloromycetin, has been named Detroit's "outstanding woman of the year."

Carl A. Schenk, of Lindenfels, Germany, has arrived in the U. S. for a three-month inspection tour of the "greatest chemical factories in the world." His tour, which is under the sponsorship of the American Forestry Association, will take him to Aiken, S. C., Rupert, Vt., Orrick, Calif., and Ohio. Although Dr. Schenk was born in Germany 83 years ago and educated in the University at Darmstadt, he is a pioneer American forester. In 1896 he came to the U. S. to found the Biltmore Forest School on the estate of George Vanderbilt at Asheville, N. C., the first school of forestry in this country. He remained until 1918, working to develop American timber.

William Henry Sebrell, Jr., has been elected to the Board of Directors of the National Society for Medical Research. Dr. Sebrell is medical director of the USPHS and chief of the Division of Physiology, National Institutes of Health.

Keramos National Honorary Ceramics Fraternity at Pennsylvania State College inaugurated its series of annual lectures May 17 when **Alexander Silverman,** head of the Department of Chemistry in the University of Pittsburgh, addressed the group on "The Newer Glasses." Dr. Silverman is retiring from teaching this spring after 46 years of service.

President Truman has nominated **Henry DeWolf Smyth** for a new five-year term on the Atomic Energy Commission. He was appointed as the "scientist member" of the five-man commission in 1949 to succeed Robert F. Bacher. Dr. Smyth had told President Truman last year that he wished to return to Princeton when his term on the commission expired in the fall of 1951. He explained, however, in a brief statement, that he had changed his mind and had agreed to accept renomination for a long term because "developments in the past year have brought new scope and urgency to the atomic program."

D. C. Swan, University of Adelaide; **Nolu-kane Ishii** and **José Grossman,** Brazil; **Henrik Bøgh,** Denmark; **Guido Galleatti,** University of Rome; **A. Modena,** Italian Ministry of Agriculture and Forestry; **Y. Kihara,** Japan; **William F. Raymond,** Grassland Research Station, Eng.; and **J. H. Jenkins,** Canadian Forest Products Laboratory, were among foreign scientists who were recent guests of the Agricultural Research Administration.

Education

The **Association of Land-Grant Colleges and Universities** will conduct a survey of adult education activities in rural areas financed by the Fund for Adult Education of the Ford Foundation. It will be directed by Charles P. Loomis, head of the Department of Sociology and Anthropology, Michigan State. Dr. Loomis is at present on leave in Costa Rica directing a rural social study sponsored by the Carnegie Foundation, the USDA, and Michigan State in cooperation with the Institute of Inter-American Agricultural Sciences, Turrialba.

Graduate students, staffs of other universities and colleges, and staff members from public education systems, will participate in the fourth **Columbia University** Community Survey Project. Under the direction of William W. Waite, of the Department of Industrial Engineering, project members will work in Winsted, Conn., 26 miles northwest of Hartford. Columbia students will interview industrial and labor leaders and public officials in an effort to discover the interrelationships among industry, government, and resources.

Cornell University Housing Research Center will begin a study of the commuting habits of industrial workers in its Journey to Work Project, under a grant from the U. S. Housing and Home Finance Agency. The project will involve an analysis of commuting patterns during World War II of employees in typical industrial centers, and an intensive study of present commuting practices in several upstate New York manufacturing cities. Co-directors of the work are Leonard Adams and Thomas W. Mackesey.

The Patent Foundation, a nonprofit organization for research and education in patent, trade-mark, copyright, and related laws, has been established at the **George Washington University** Law School. An Advisory Council of not more than 21 members is to be appointed. Honorary members of the council will include Joseph W. Barker, Vannevar Bush, Cyrus S. Ching, John W. Davis, Charles F. Kettering, and Max McGraw.

The **University of Illinois** has received a gift of a $90,000 television transmitter from the General Electric Company. Transmission is not expected to begin before 1952, however. The university has also received $245,350 from the W. K. Kellogg Foundation to "strengthen educational broadcasting."

Under the direction of the American Library Association a library training school has been established at **Keio University** in Tokyo. A one-year course, with a staff of six Americans headed by Robert L. Gitler, of the University of Washington, was begun in April.

Northwestern University School of Law will give its annual short course for law enforcement officials of the U. S., Canada, and Central and South America August 13–18. Designed primarily to familiarize prosecutors with scientific methods of crime investigation, the course will be under the direction of Harold C. Havighurst and Fred E. Inbau, with a staff of 13. For further information address the school at Lake Shore Dr. and Chicago Ave., Chicago.

The **Pacific Science Board** of the National Research Council is continuing its coral atoll research program. A six-man team of scientists will spend three months in a general ecological study of the interrelationships of all forms of life, including that of the native population, on Onotoa, a heavily populated dry atoll in the southern Gilberts. Preston Cloud is leader of the expedition, of which the other members are Albert Banner, Ward Goodenough, Edwin T. Moul, Donald Strasburg, and John E. Randall, Jr. The work will be financed in part by a grant from ONR, with cooperation in equipment and transportation from the Army, Navy, and U. S. Coast Guard, as well as from the U. K. High Commissioner of the Western Pacific and administrative officials of the Gilbert and Ellice Island Colony. The Pacific Science Board has also assigned Harry Uyehara and Leonard Horwitz to undertake a follow-up study on Arno Atoll in the Marshalls.

Rutgers University recently dedicated its new Lipman Hall, named for Jacob G. Lipman, who, fifty years ago this month, founded the Department of Soil Chemistry and Bacteriology, first of its kind in the U. S. The new building will house three departments —Microbiology, Soils, and Farm Crops—providing space for nearly 200 laboratory workers, besides offices and classrooms.

Thirty-one **South Dakota School of Medicine** sophomores will spend a month this summer as clinical clerks with doctors in all parts of the state, in practical preparation for their advanced work in medicine.

Meetings and Elections

At the Annual Meeting of the **American Neurological Association** in Atlantic City, the following officers were elected for 1951–52: president, S. Bernard Wortis; president-elect, Hans H. Reese; vice presidents, Frederick P. Moersch and A. Earl Walker; secretary-treasurer, H. Houston Merritt; assistant secretary, Charles Rupp.

Some 175 microbiologists from eight provinces of Canada met June 7–8, at the University of Ottawa, and formed a **Canadian Society of Microbiologists** (Société Canadienne des Microbiologistes). Officers of the new society are: president, R. G. E. Murray; vice presidents, Maurice Panisset and A. G. Lochhead; secretary-treasurer, N. E. Gibbons. A council was also elected. Twenty-five papers, dealing with general, agricultural, industrial, and medical microbiology, were presented at the inaugural meeting.

An international **Conference on Automatic Control** will be held at the College of Aeronautics, Cranfield, near Bedford, Eng., July 16–21. Dr. Van der Pol, John Cockcroft, Charles Goodeve, A. Tustin, E. O.

Willoughby, and J. Z. Young will be among the chairmen of discussions, and papers will be read by scientists from Canada, France, Germany, Holland, Sweden, Switzerland, and the U. S. Ben Lockspeiser, secretary of the DSIR, will give the presidential address.

The **Pennsylvania Academy of Science** elected the following officers at its annual meeting: president, Walter S. Lapp; president-elect, Edward P. Claus; vice presidents, Anna A. Conn and Albert L. Billig; secretary-treasurer, Harry K. Lane. The 26th annual summer meeting will be held at Uniontown August 3–4. Field trips are being arranged to places of geological, industrial, botanical, and historical interest, as well as to federal flood control projects. Anna A. Conn is chairman of the local committee.

Recent Deaths

Michael J. Ahern (74), geologist and chemist, Boston, June 5; **E. Gordon Bassett** (60), linguist, Brewster, Mass., June 10; **Paul V. C. Baur** (79), archaeologist, New Haven, June 5; **Ernest H. Billipp** (69), engineer and inventor, Rye, N. Y., June 8; **Sherman C. Bishop** (63), zoologist, Rochester, N. Y., May 28; **William S. Bowen** (84), obstetrician, Washington, D. C., May 18; **Lillian Brandt** (78), welfare research worker, New York, June 4; **Boyd Brown,** of Denver, hydroelectric expert, in Managua, Nicaragua, June 9; **Harry P. Brown** (64), wood technologist, Syracuse, N. Y., May 24; **Emil-Auguste Chartier** (83), philosopher and educator, Paris, June 3; **Edward S. Cowdrick** (68), industrial relations consultant, Bayside, Queens, N. Y., May 24; **Charles H. Davis** (86), civil engineer, New York, June 3; **Raymond A. Dobbins** (54), biologist, Albany, N. Y., Nov. 3, 1950; **George Dock** (91), physician and educator, Altadena, Calif., May 30; **Alvin E. Dodd** (68), industrial management expert, New York, June 3; **Lucius F. Donohoe** (83), surgeon and civic leader, New York, May 23; **John L. Drake** (59), mechanical engineer, Toledo, Ohio, June 19; **Lincoln Ellsworth** (71), explorer, New York, May 26; **Austin Lee Ely** (61), chemist, Appleton, Wis., May 25; **Warren E. Emley** (65), chemist, New Brunswick, N. J., June 5; **Herman L. Enselberg** (53), gynecologist, New York, June 15.

Eugene Fiset (77), former Canadian surgeon-general, Riviere du Loup, Que., June 8; **David St. Pierre Gaillard, Jr.** (28), electrical engineer, Washington, D. C., June 9; **Walter E. Garrey** (77), physiologist, Nashville, Tenn., June 15; **F. Lynwood Garrison** (89), mining engineer, Philadelphia, June 10; **James T. Gerould** (78), librarian, Williamsburg, Va., June 8; **Curvin H. Gingrich** (70), astronomer and mathematician, Northfield, Minn., June 17; **John S. Grainer** (80), past president American Ceramics Society, Cleveland, May 24; **Morris Gruenebaum** (65), dentist and sculptor, Cincinnati, May 16; **B. Wallace Hamilton** (73), medical leader, New York, June 4; **Gorham W. Harris** (66), chemist, Newton, Mass., June 18; **Joseph V. Hogan** (65), engineer, Baltimore, June 7; **Herman A. Hoster** (39), oncologist, Columbus, Ohio, May 14; **Harry M. Imboden** (72), radiologist, New Rochelle, N. Y., June 13; **Frederick G. Jones** (67), ear, eye, nose, and throat specialist, Utica, N. Y., June 5; **James P. Kinard,** educator, Rock Hill, S. C., May 31; **Benjamin R. Kittredge** (92), creator of South Carolina's Cypress Gardens, Charleston, S. C., May 31; **Napoleao Laureano** (36), cancer specialist, Rio de Janeiro, May 31; **William C. Lees** (76), textile manufacturer, Hollingsworth, Eng., May 26; **Isaiah B. Levitch** (65), physician, New York, May 30; **Frederick T. Lewis** (76), anatomist, Newton, Mass., June 2; **Clinton Lockhart** (93), educator, Fort Worth, Tex., June 11.

R. M. McDill (79), mathematician, Hastings Neb., Mar. 19; **Rudolph A. McGovern** (63), mining engineer and geologist, New York, June 13; **William MacNider** (70), pharmacologist, Durham, N. C., May 31; **Maxwell C. Maxwell** (75), mechanical engineer, Cambridge, Md., June 13; **Jacob L. Maybaum** (67), ear, nose, and throat specialist, New York, May 31; **Vladimir Mitkevich** (79), electrical technologist, Moscow, June 2; **Samuel R. Moreno** (53), psychiatrist, Mexico City, Apr. 12; **Victor P. Morey** (46), educator, Wakefield, Neb., May 18; **Robert B. Morton** (73), electrical engineer, Montclair, N. J., May 19; **Herbert L. Nossen** (55), physician and psychotherapist, New York, June 2; **Franklin W. Olin** (91), industrialist, St. Louis, May 21; **Otto W. Osterlund** (52), educator, Philadelphia, Apr. 20; **Philip M. Palmer** (71), educator, Claremont, Calif., June 4; **William A. Peterson** (83), botanist, St. Petersburg, Fla., June 6; **David J. Price** (67), chemical engineer, Washington, D. C., May 28.

Alfred J. Reis (69), metallurgist, New Brunswick, N. J., May 19; **Frank W. Reynolds** (83), industrial engineer, Winchester, Mass., May 27; **Hiram Rivitz** (68), industrialist, Cleveland, June 4; **Robert G. Robb** (75), chemist, Williamsburg, Va., Mar. 17; **Lonsdale J. Roper** (65), Virginia Health Commissioner, Richmond, June 12; **Will Ross** (62), former president National Tuberculosis Association, Milwaukee, May 31; **Porter C. Savage** (72), solid fuels expert, Clifton Springs, N. Y., May 24; **Daniel M. Schoemaker** (83), anatomist, St. Louis, May 27; **Ruell A. Sloan** (42), pathologist, Chevy Chase, Md., June 17; **Lois T. Slocum** (52), astronomer, Chambersburg, Pa., May 25; **Darrell H. Smith** (62), executive secretary Brookings Institution, Washington, D. C., June 9; **Joseph Stenbuck** (59), surgeon, New York, June 1; **A. H. Sutherland** (72), psychologist, Alexandria, La., May 18; **Thomas C. Trueblood** (95), educator, Bradenton, Fla., June 4; **Joseph L. Turner** (70), technical consultant National Lead Co., Fair Haven, N. J., June 12; **Roy V. Van Dike** (40), submarine engineer, Cleveland, June 4; **Paul C. Van Zandt** (73), cement engineer, River Forest, Ill., May 26; **Harry P. Wareham** (68), executive vice president American Hearing Society, Westport, N. Y., June 11; **Robert B. Wasson** (73), consulting engineer and inventor, Cranford, N. J., May 29; **John J. Wittmer** (55), leader in industrial medicine, New Canaan, Conn., May 19; **John Zeleny** (79), physicist, New Haven, June 19.

Meetings & Conferences

July 11–13. Conference on Aging (Annual). University of Michigan, Ann Arbor.
July 21–26. Conference on American Foreign Policy (Annual). Colgate University, Hamilton, N. Y.
July 23–26. Conference on Auroral Physics. University of Western Ontario, London, Can.
Aug. 6–12. British Association for the Advancement of Science. Edinburgh.
Aug. 13–Sept. 7. Canadian Mathematical Congress (Summer Seminar). Dalhousie University, Halifax.
Aug. 14–16. Conference on Prestressed Concrete, MIT, Cambridge, Mass.
Aug. 20–23. American Institute of Electrical Engineers (Pacific). Multnomah Hotel, Portland, Ore.
Aug. 20–23. National Council of Teachers of Mathematics (Annual). St. Olaf College, Northfield, Minn.
Aug. 22–25. Plant Science Seminar. University of Buffalo School of Pharmacy, Buffalo, N. Y.
Aug. 23–30. Institute for Teachers of Mathematics. Connecticut College, New London.
Aug. 26–31. American Pharmaceutical Association. Statler Hotel, Buffalo.
Aug. 27–30. Illuminating Engineering Society. Washington, D. C.
Aug. 27–30. Social Work Institute, including discussions on the Problem of Old Age. Valparaiso University, Valparaiso, Ind.
Aug. 27–31. American Society of Agronomy. Pennsylvania State College, State College.
Aug. 27–31. Soil Science Society of America. Pennsylvania State College, State College.
Aug. 31–Sept. 5. American Psychological Association. Hotel Sherman, Chicago.
Sept. 1–3. Astronomical League. University of North Carolina, Chapel Hill.
Sept. 3–4. Mathematical Association of America (Summer). University of Minnesota, Minneapolis.
Sept. 3–7. American Chemical Society (Annual). New York.
Sept. 3–8. International Congress on Astronautics. London.
Sept. 4–7. American Mathematical Society (Summer). University of Minnesota, Minneapolis.
Sept. 5. Calorimetry Conference. Pupin Physics Laboratory, Columbia University, New York.
Sept. 7–9. International Medical Congress. Evian, France.
Sept. 8–9. International Union of Pure and Applied Chemistry. New York.
Sept. 8–15. American Occupational Therapy Association (Annual). New Castle, N. H.
Sept. 9–14. International Gerontological Congress. Hotel Jefferson, St. Louis.
Sept. 9–15. International Congress of Industrial Medicine. Lisbon.
Sept. 10–13. International Congress of Pure and Applied Chemistry. New York.
Sept. 10–14. Instrument Society of America. Sam Houston Coliseum, Houston, Tex.
Sept. 10–15. American Institute of Biological Sciences (Annual). University of Minnesota, Minneapolis.
Sept. 13–14. Conference on ACTH. Harrogate, Eng.
Sept. 14–15. International Union of Pure and Applied Chemistry. Washington, D. C.
Sept. 15–21. World Medical Association. Stockholm.

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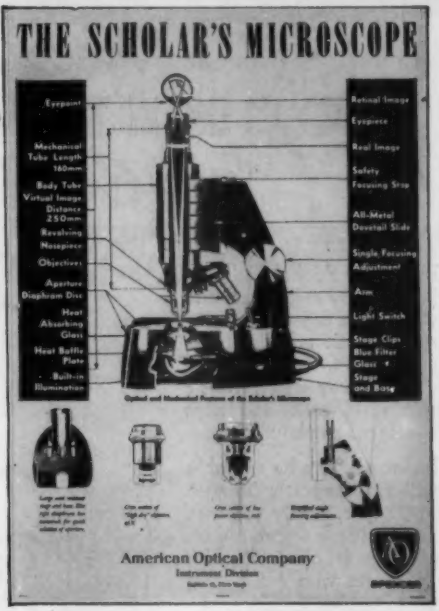

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